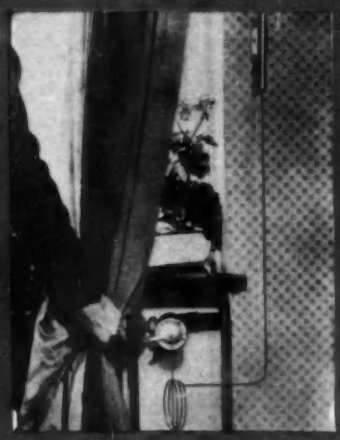
ENGINEERING AND

BOILER HOUSE REVIEW

VOL. 73 NO. 2 • THE PIONEER STEAM JOURNAL • FEBRUARY, 1958

Now also for low pressure steam plants!



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Normal design with fixed phial.

Special design with capillary tube and loose phial, which can be used where the natural air circulation is checked.

Special design for covered radiators.

Do it with

Danfoss **thermostatic radiator valve**

- Great sensitivity
- Economical operation of the plant
- Easy operation
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- Phial unit can be interchanged without draining of the system
- Will prevent freezing
- Temperature range between 37.4° F. and 77° F.

The Danfoss Thermostatic Radiator Valve is provided with an adjustable temperature scale and is constructed so that each radiator is regulated separately. It can be used for all central heating plants and gives a new feeling of comfort as well as a considerable saving of fuel.

With a Danfoss Thermostatic Radiator Valve you determine the temperature.

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everything under Danfoss control

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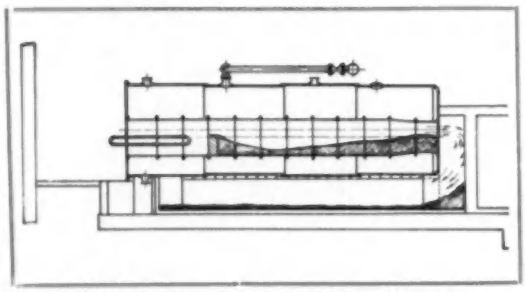
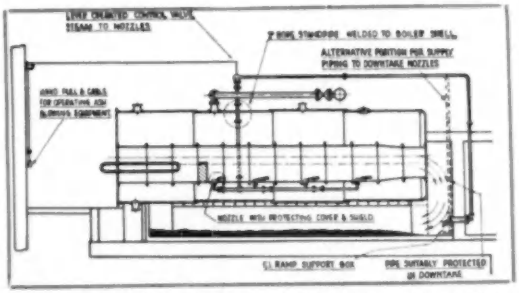
IT COSTS TOO MUCH!

TO IGNORE MODERN BOILER FLUE CLEANING METHODS



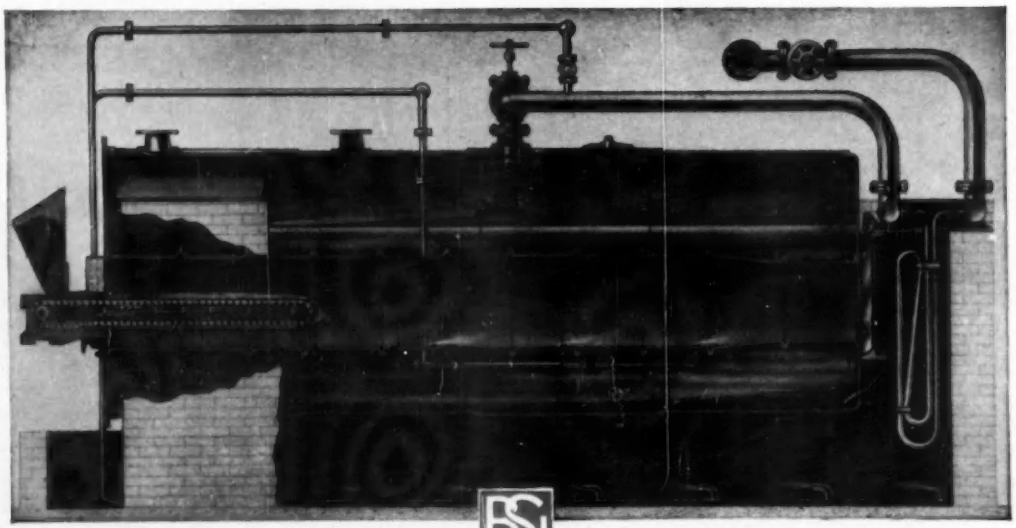
STOP THIS WASTE AND INEFFICIENCY—

ash deposit in the furnace tubes is the cause.



WITH 'BOLTON-GRAY' ASH BLOWING EQUIPMENT
(MODEL A)

ash is blown clear at will, maintaining the full designed heating surfaces.



MODEL B maintains the same conditions in the furnace tubes as Model A but with additional application to the flame bed, side flues, economiser chamber and final removal of ash to settling chamber. Boilers fitted with Model B can remain in service for periods up to twelve months without shutdown. Please write for brochure.

For clean air and reduced costs fit

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BOLTON'S SUPERHEATER & PIPE WORKS LTD. STOCKPORT

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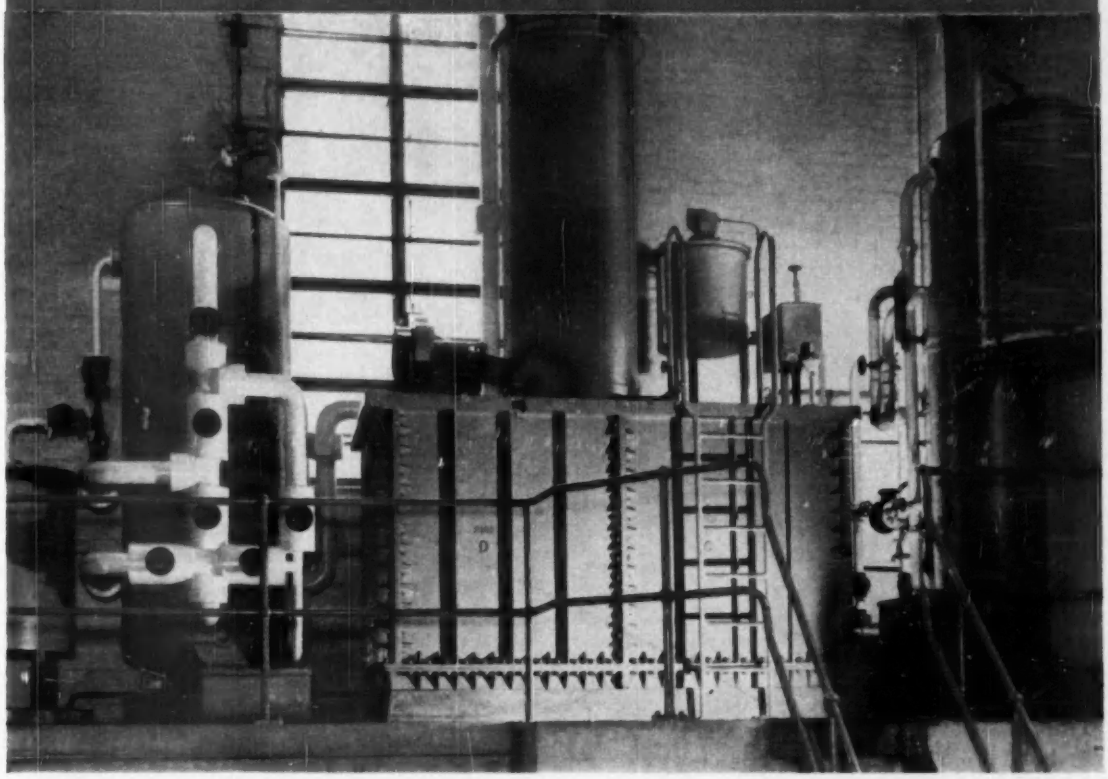

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The Starvation/Base Exchange water treatment plant shown above produces a perfect boiler feed water with the following characteristics and advantages

- Reduced total dissolved solids.
- Controlled alkalinity.
- Zero hard water.
- No sludge.

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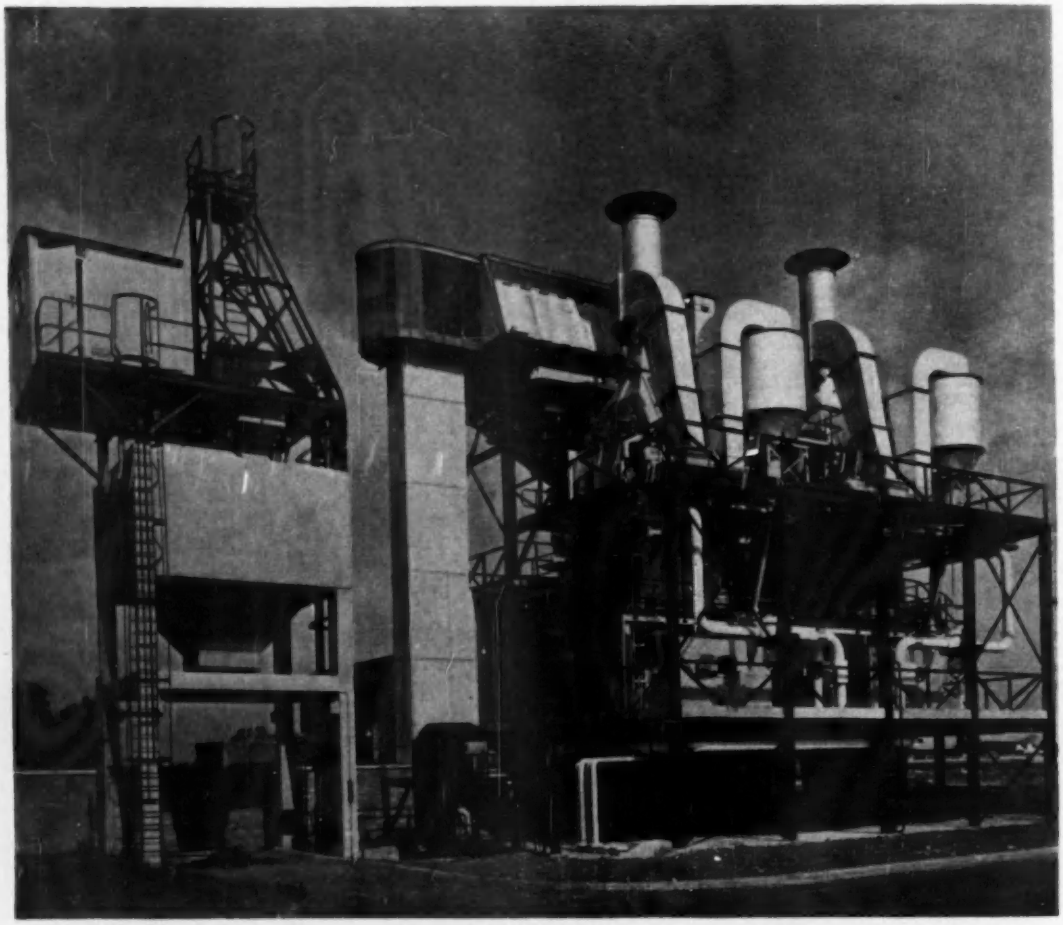
LA MONT HOT WATER BOILERS

HIGH, MEDIUM and LOW PRESSURES



Two 15 million B.T.U.s/hr. high temperature LA MONT Hot Water Boilers installed in Bedfordshire to the design and to the requirements of the Chief Mechanical and Electrical Engineers Division of The Ministry of Works.

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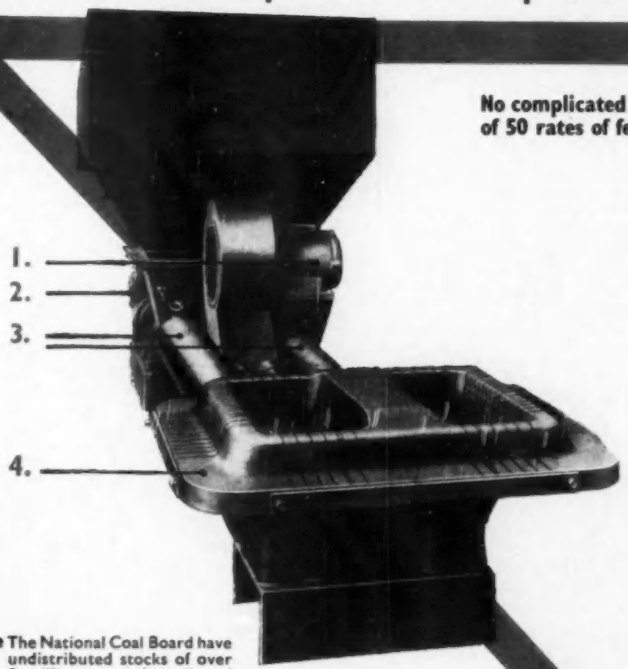

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4. Tuyeres can be supplied in 30% chrome iron.
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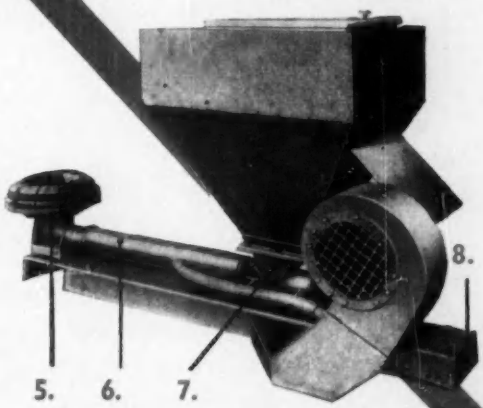
6. Patent high pressure air supply to annulus makes it possible to guarantee that the Meterfeed stoker will not smoke back through the hopper.
7. Fine pitch worm meters fuel to main conveyor worm.
8. Baseplate forms air duct and maintains alignment of machine.



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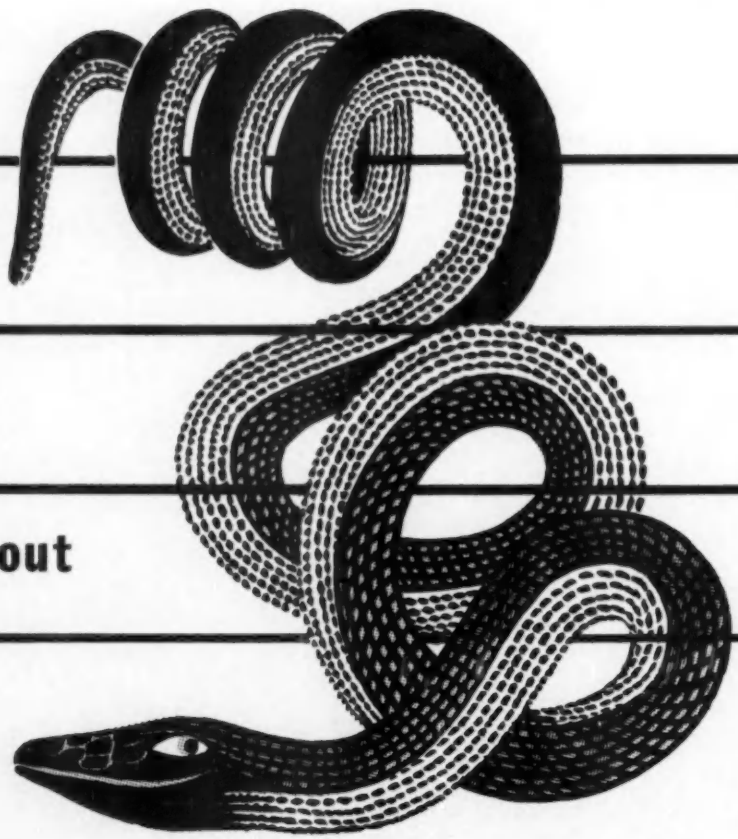

He would wriggle out of it

Someone must take the blame though—after all, corrosion in the boilers indicates an expensive blunder on somebody's part.
How easy to have specified "Apexior" at the beginning. "Apexior Number 1" positively prevents corrosion in boilers and steam-raising plant, where wet temperatures between 175° and 1000°F. are encountered. Absolute protection is assured with a yearly double coating, mechanically or brush applied. This also enables easier descaling as scale does not accumulate so much nor adhere so firmly to Apexiorised surfaces. For over 50 years, leading manufacturers of boilers and all steam-raising plant have relied on "Apexior" to fight their corrosion battles—why not follow their example?

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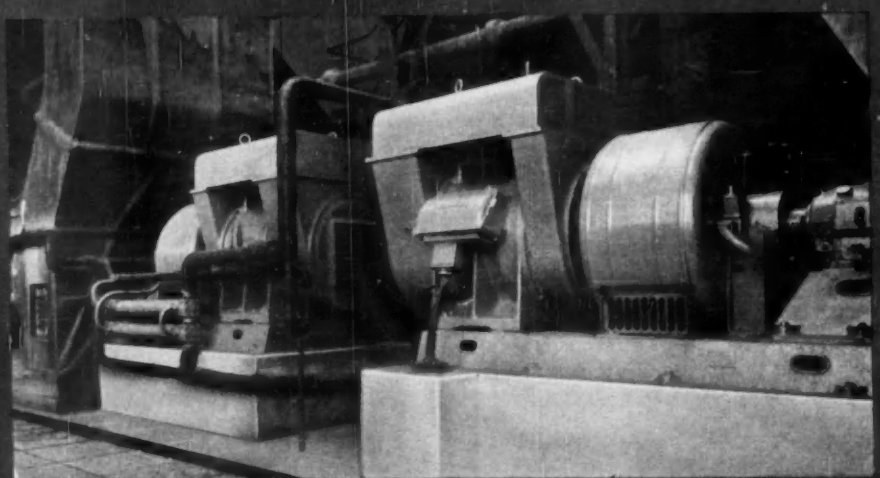

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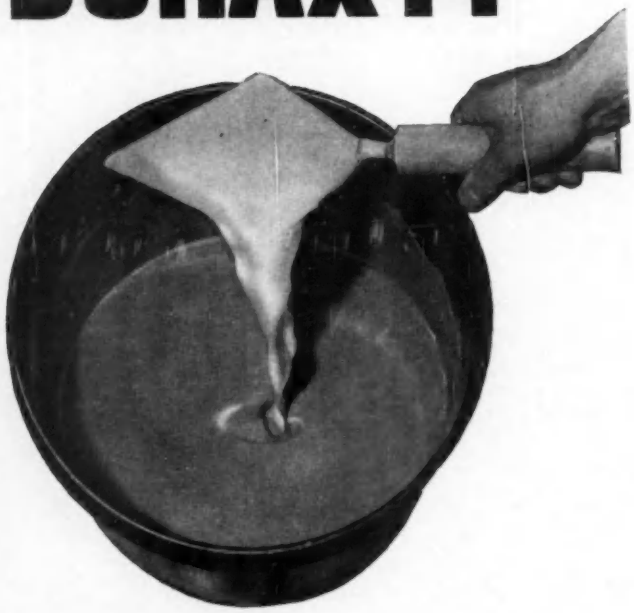
The *Time-Saving Way* to obtain THIN STRONG JOINTS



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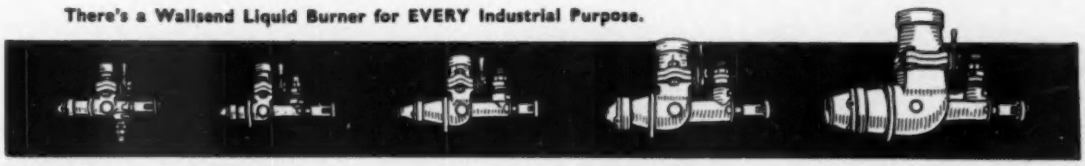

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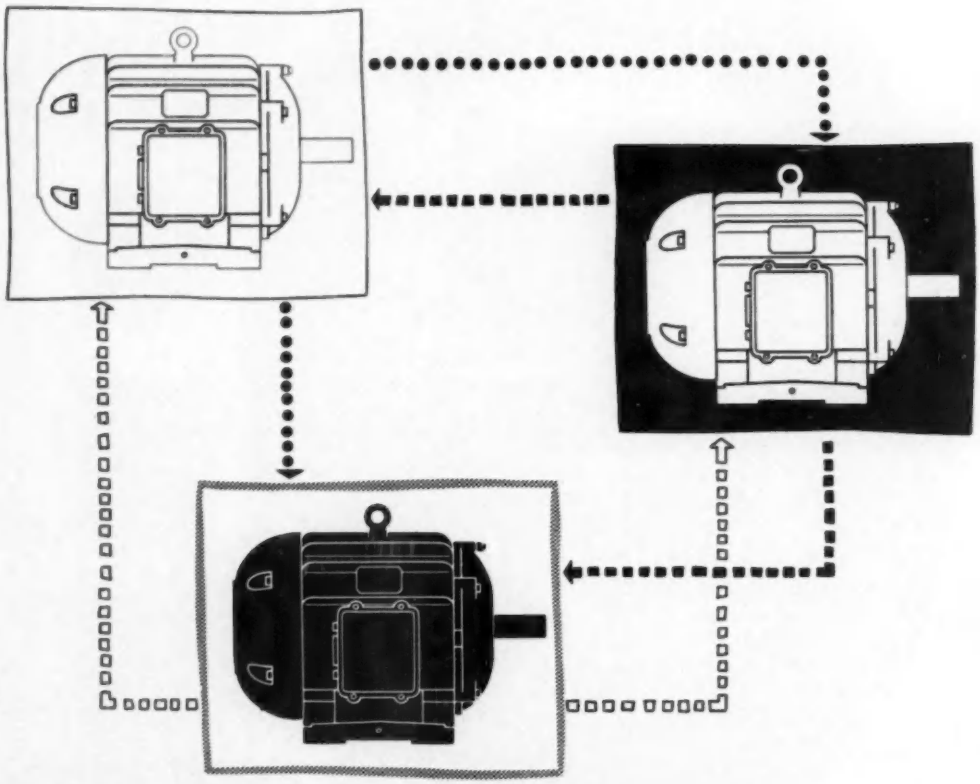
for Interchangeability



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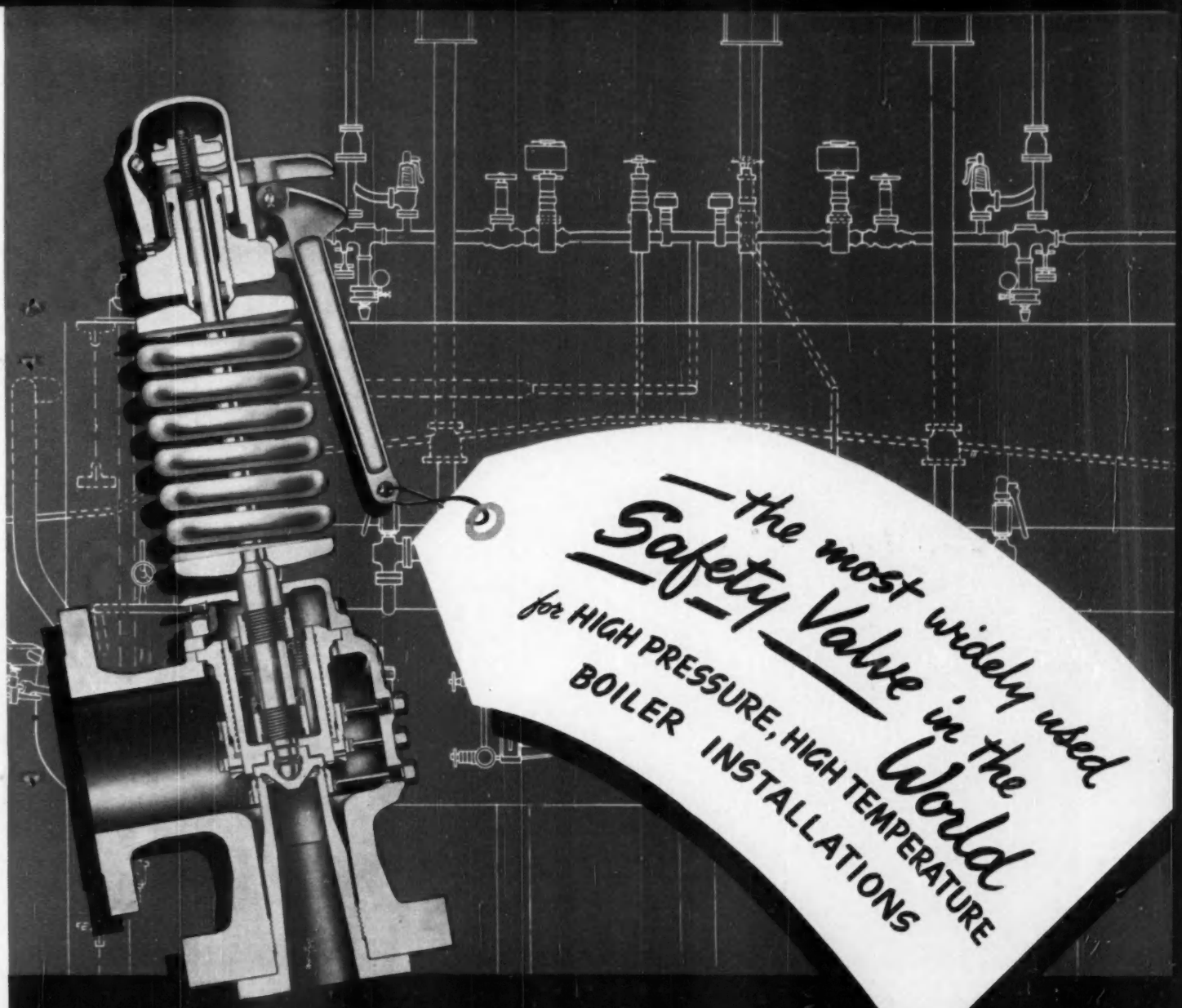

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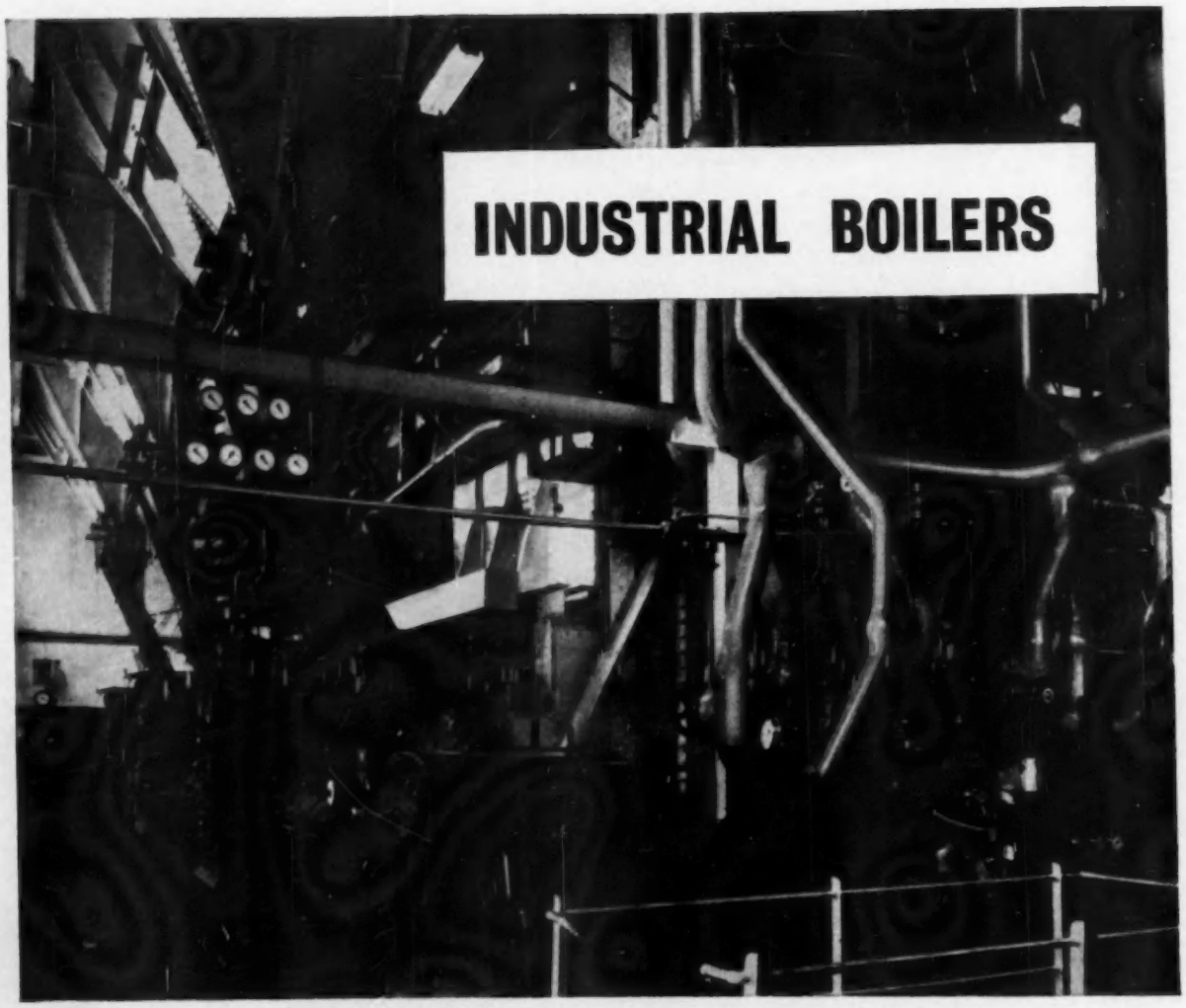

In addition to the larger units installed in many modern power stations at home and abroad, Yarrow Boilers have been supplied to meet the requirements of all classes of industrial plant. The illustration shows three of the four boilers installed at the Germiston Works of Messrs. National Chemical Products Limited in South Africa.

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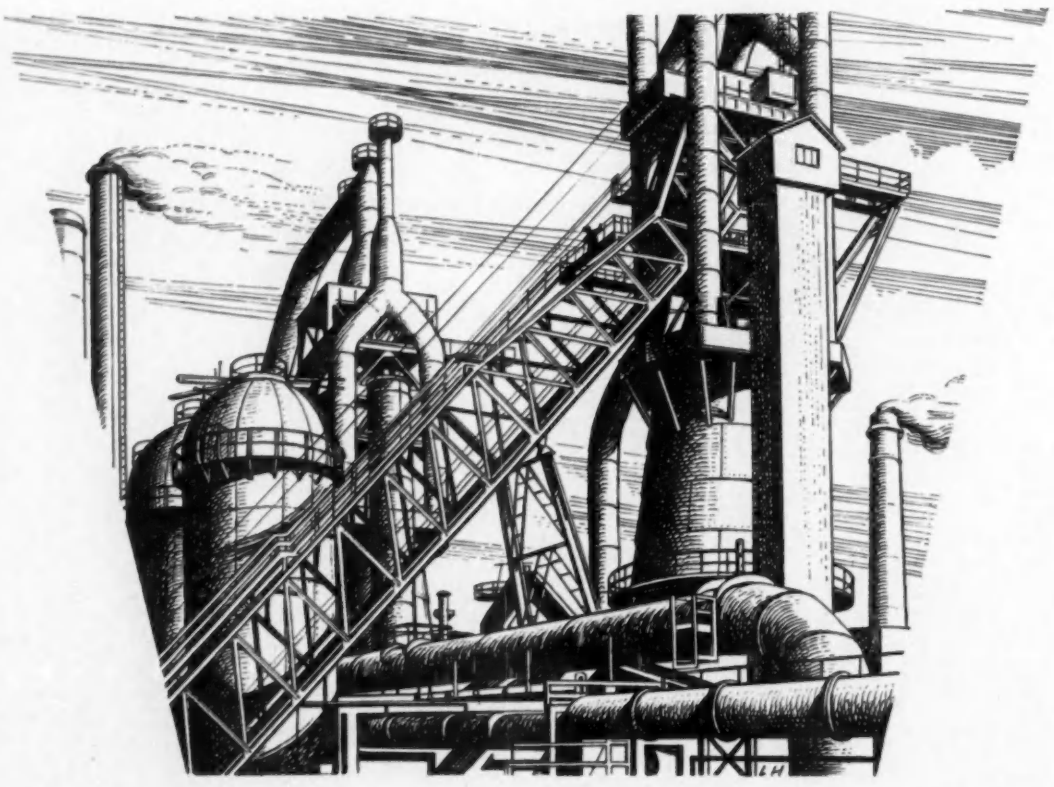

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problem

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Total Head in Feet	
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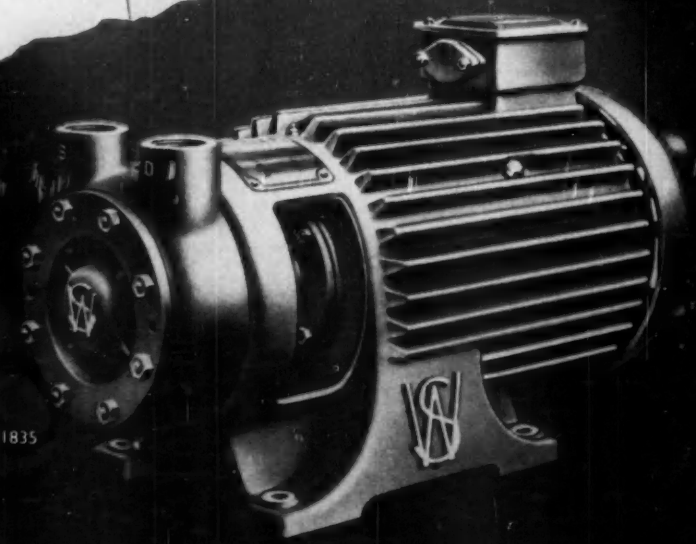

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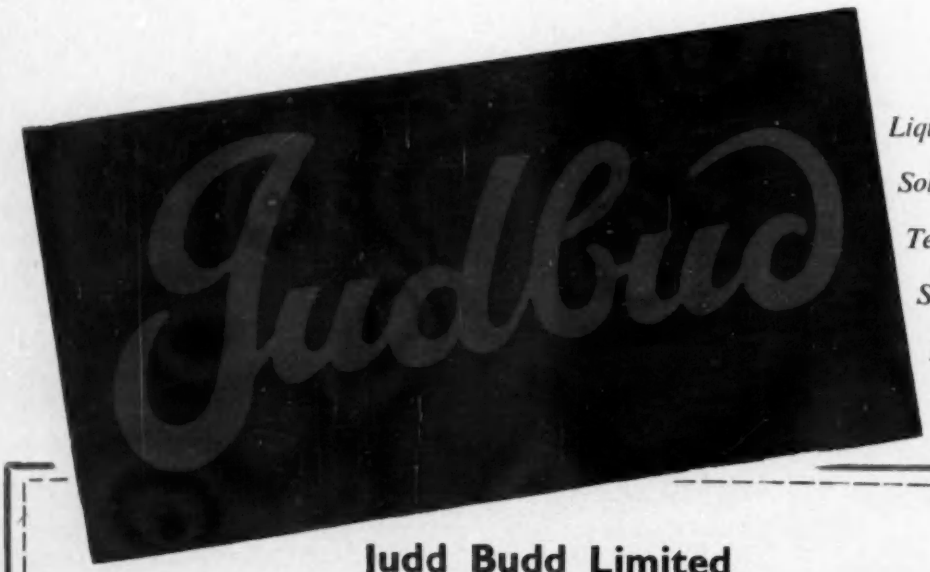

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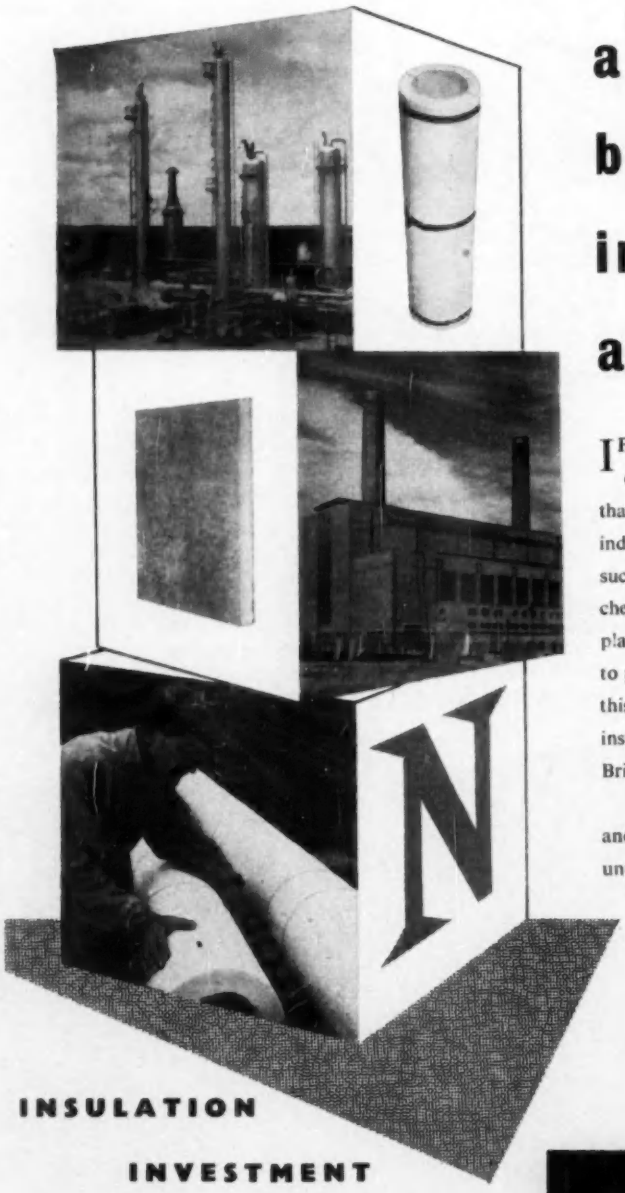

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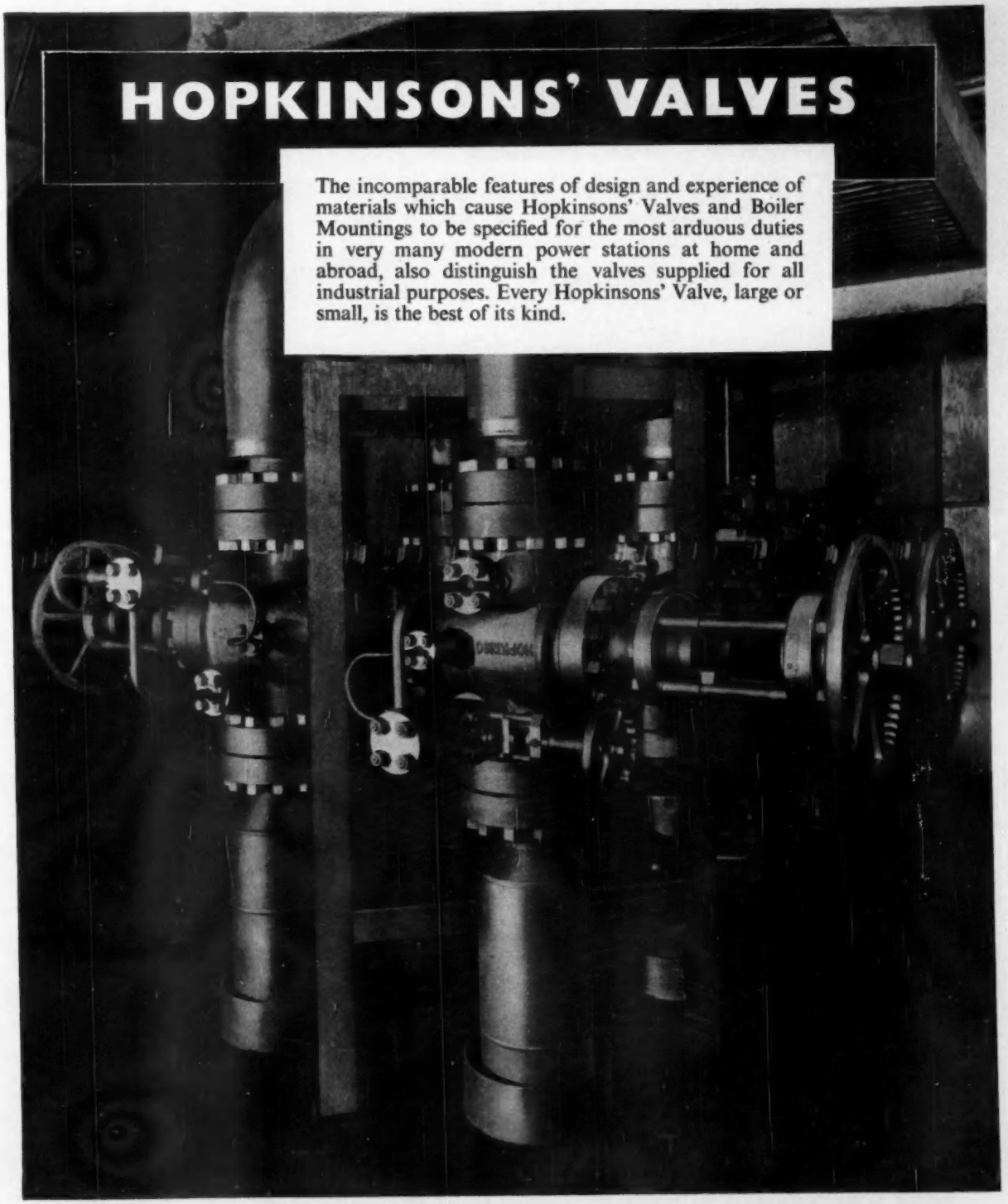

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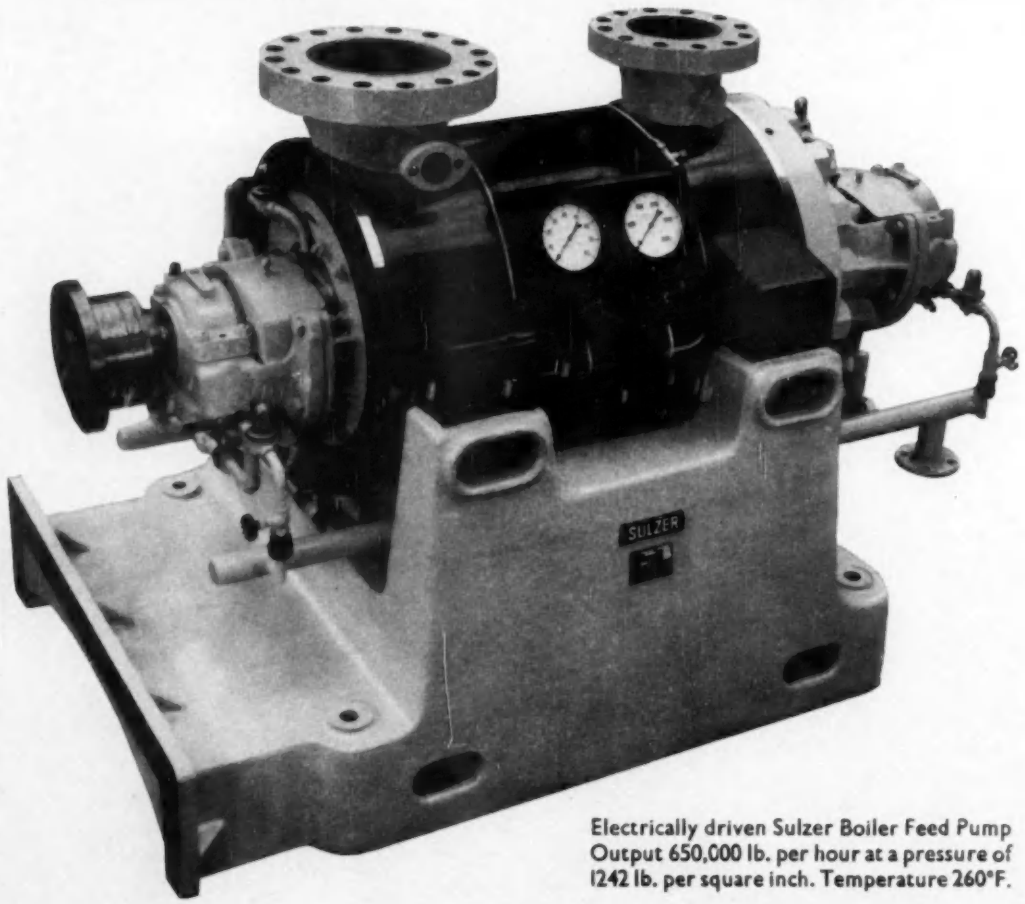
SULZER

BOILER - FEED PUMPS



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1242 lb. per square inch. Temperature 260°F.

one of nine units for
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B2

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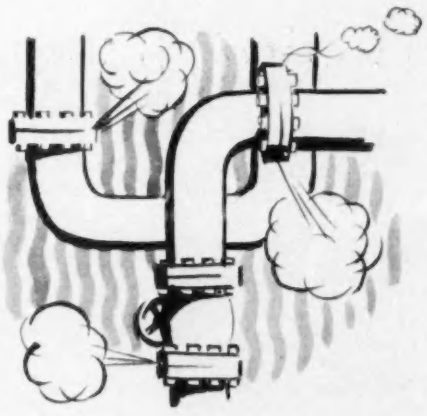

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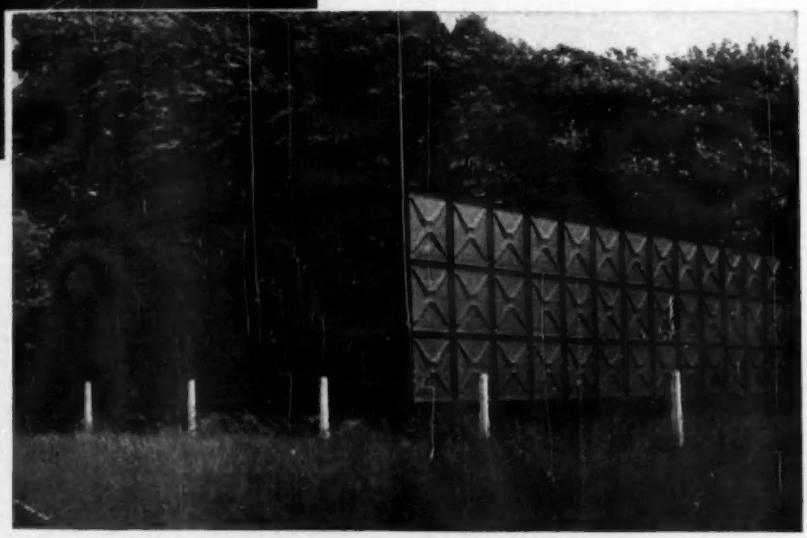
PRESSED STEEL SECTIONAL TANKS



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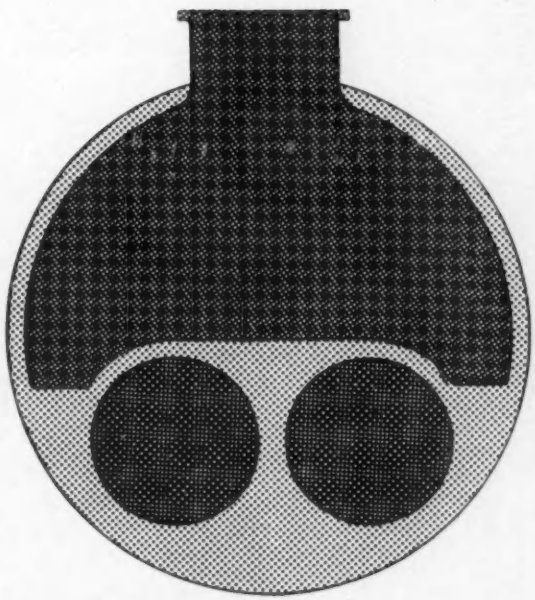

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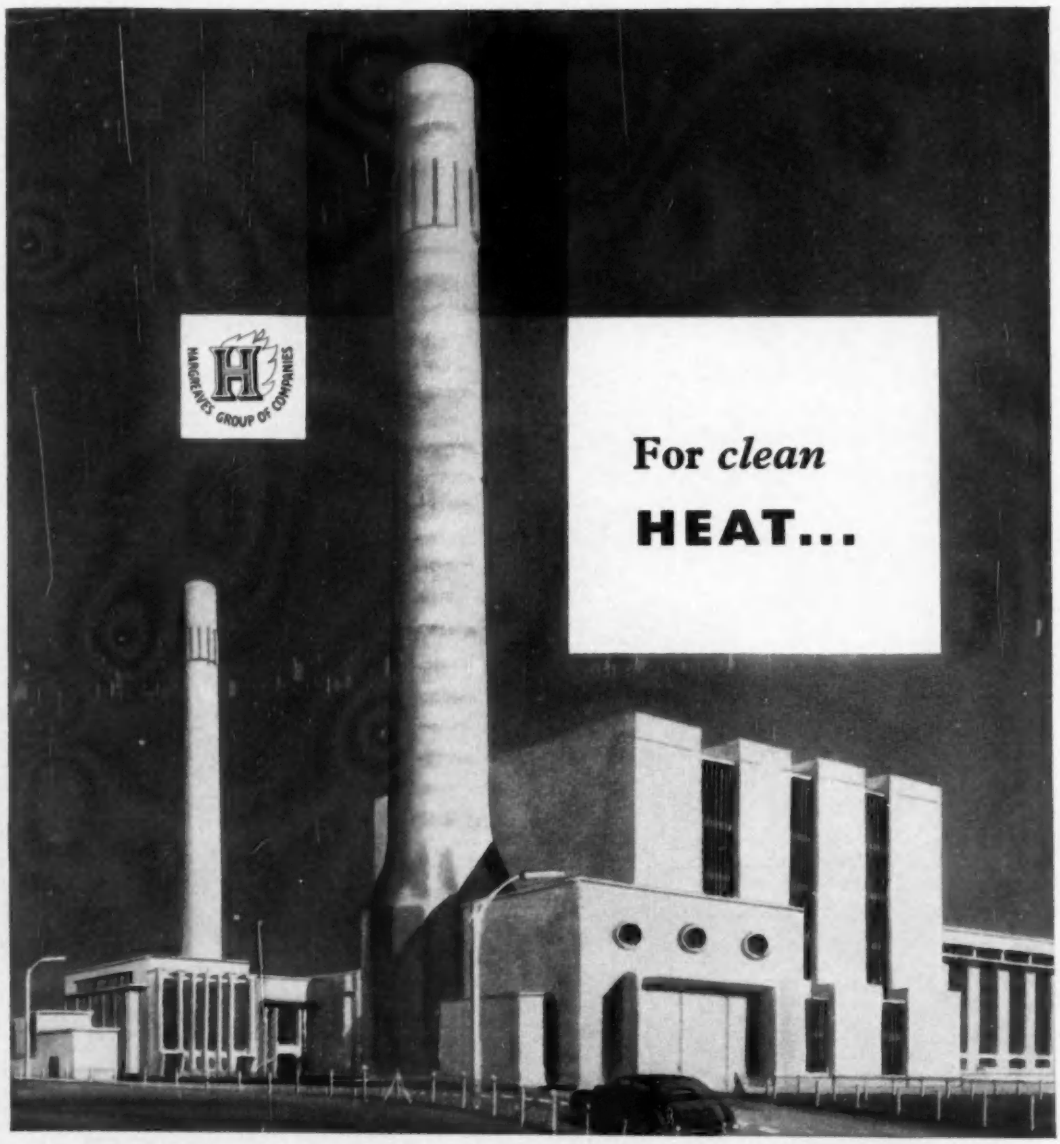

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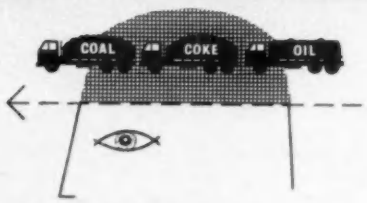

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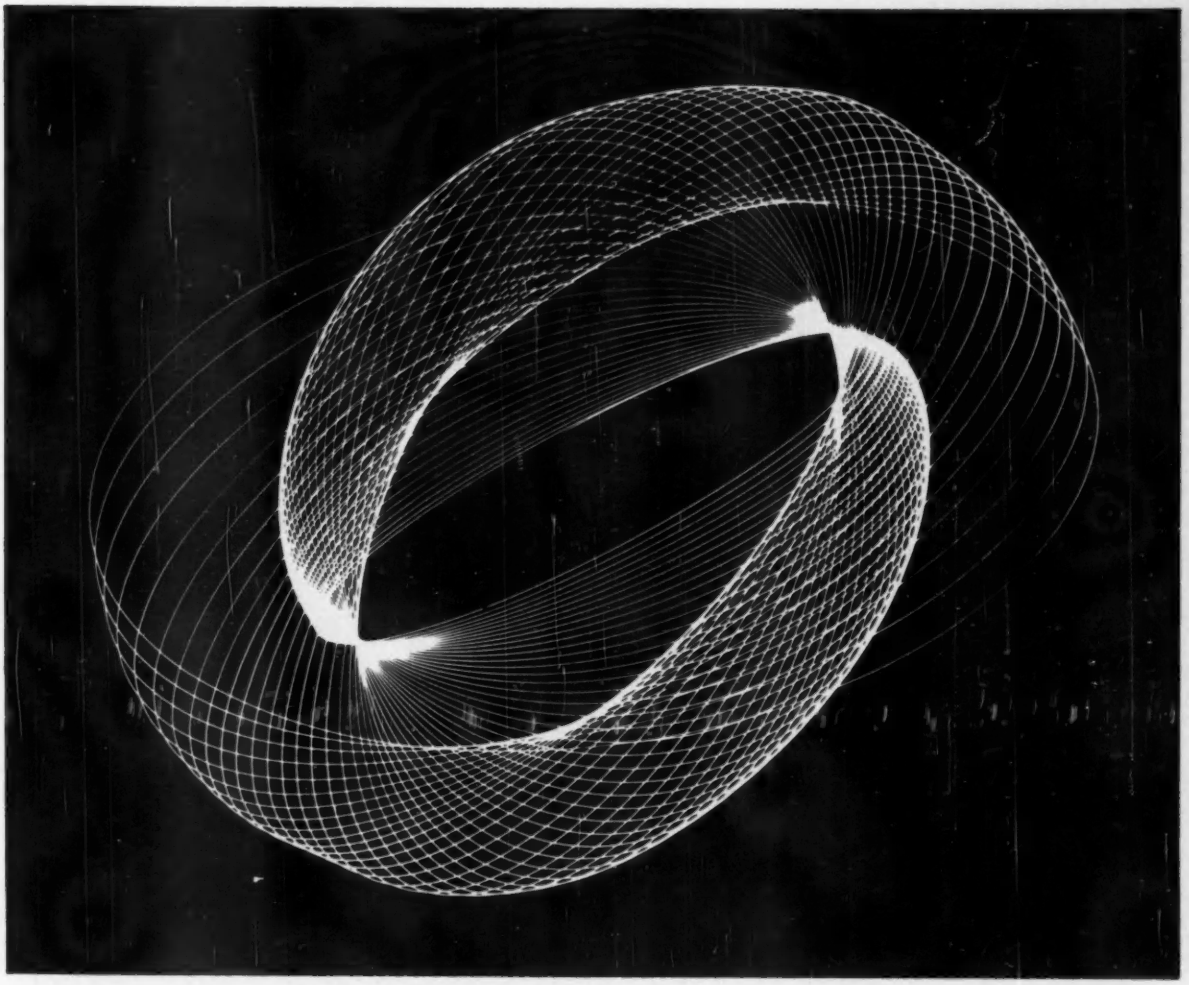

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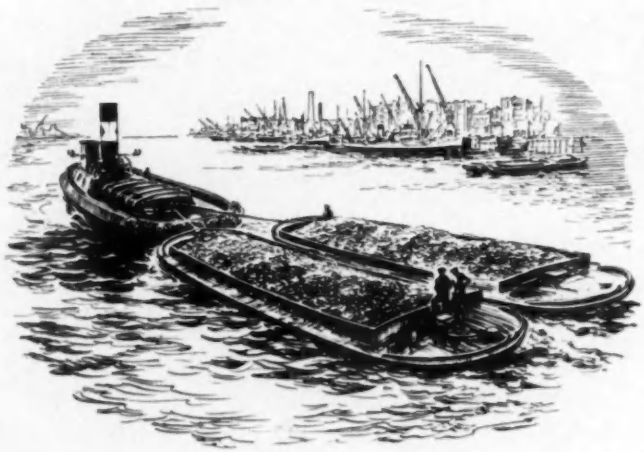

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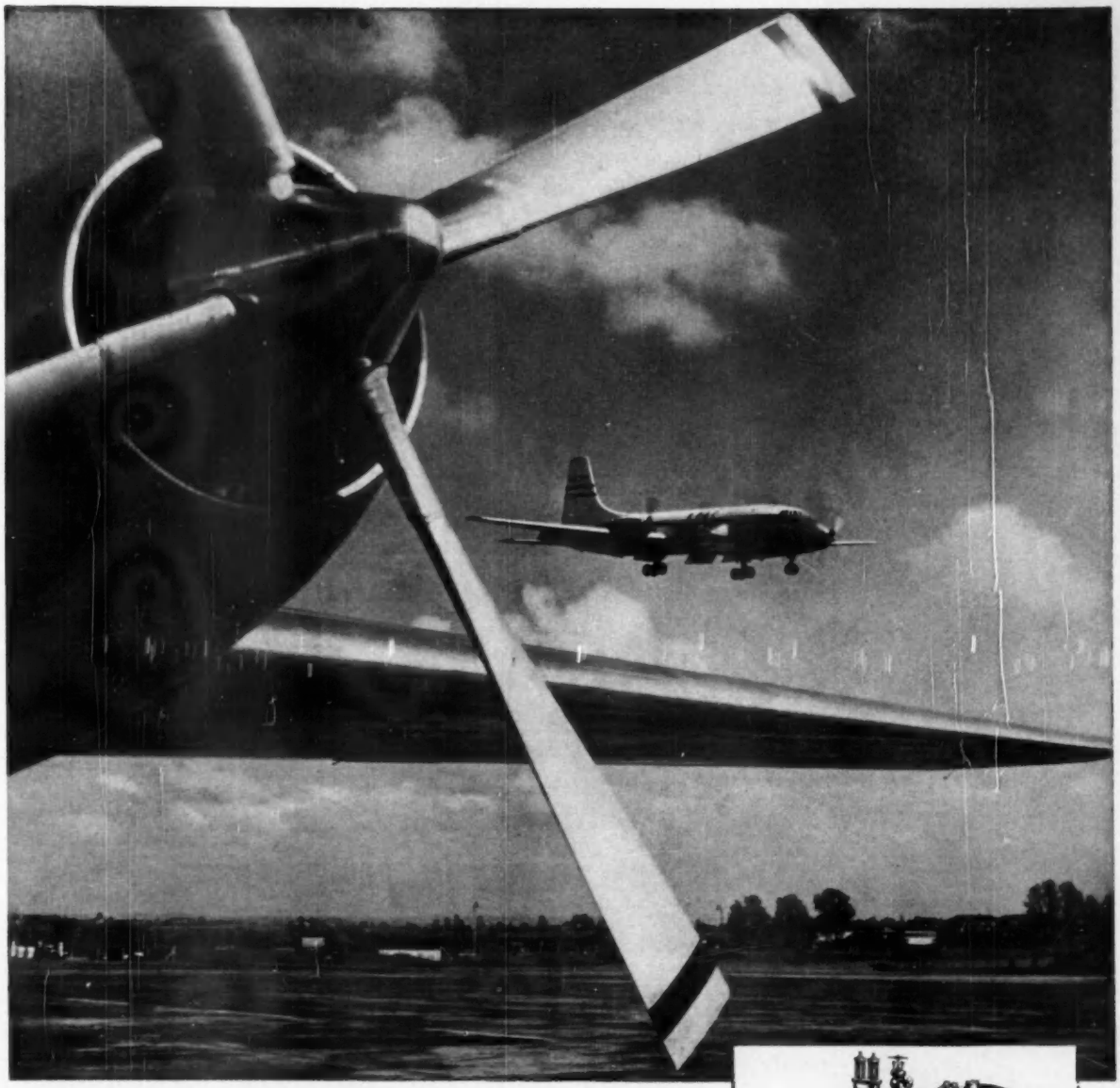

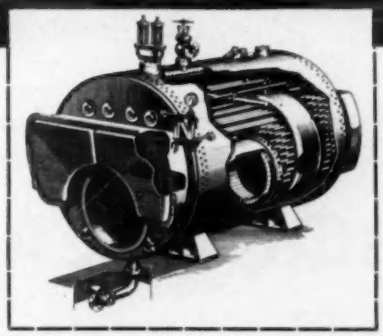

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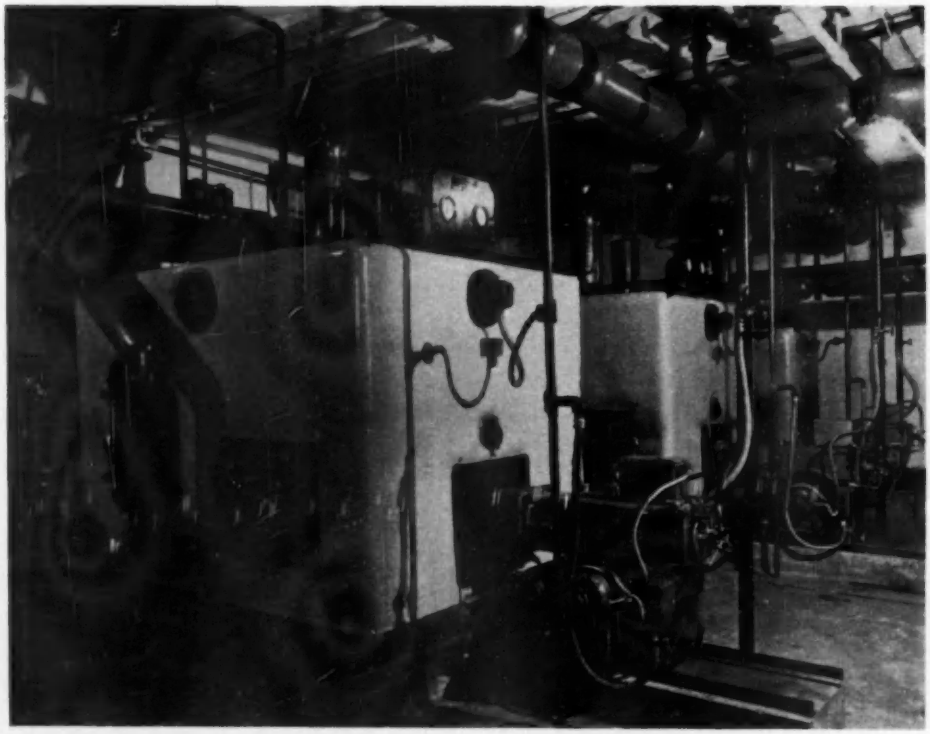

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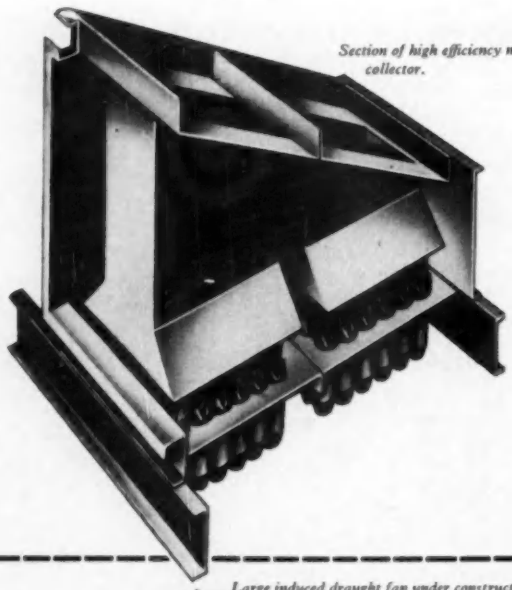

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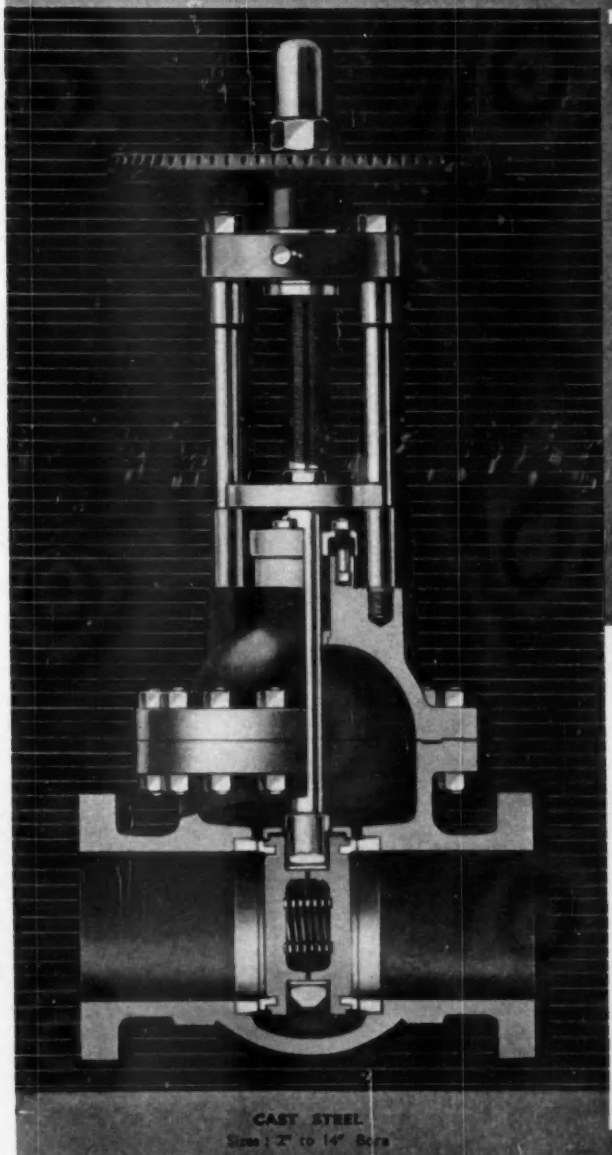

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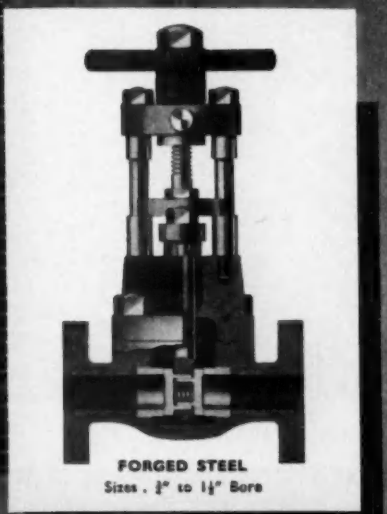

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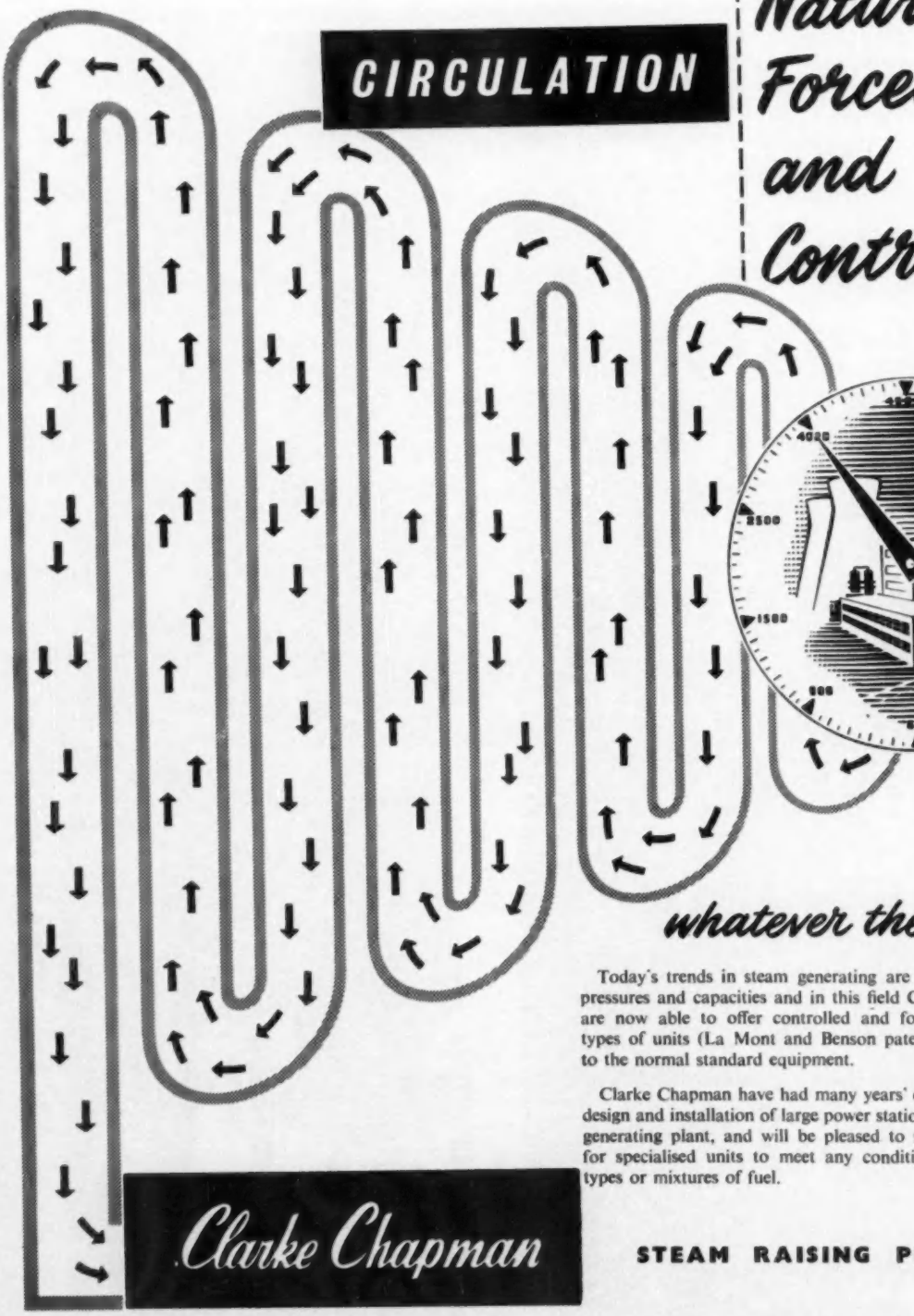

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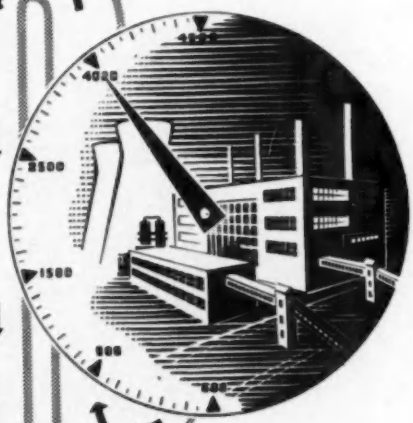

whatever the pressure

Today's trends in steam generating are towards higher pressures and capacities and in this field Clarke Chapman are now able to offer controlled and forced circulation types of units (La Mont and Benson patents) in addition to the normal standard equipment.

Clarke Chapman have had many years' experience in the design and installation of large power station and industrial generating plant, and will be pleased to receive enquiries for specialised units to meet any conditions and for all types or mixtures of fuel.

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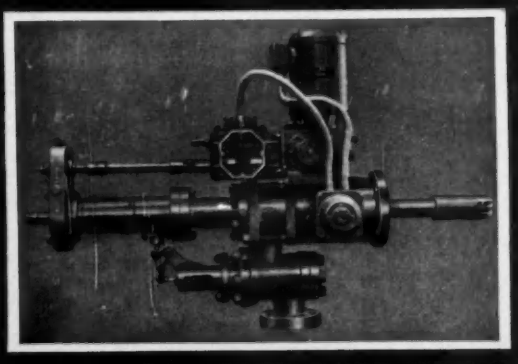
UNIFIED LECTRAMEK CONTROL SYSTEM

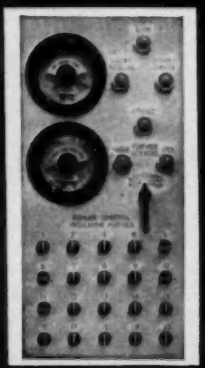
most efficient yet devised.

Considerable savings in initial cost and valuable boiler room space have been achieved by this new system of electrical control which works in conjunction with the Clyde Lectramek Soot Blower * - the original blower employing a uni-directional motor. Control is exercised from a small panel which indicates all essential information to the operator.



THE BLOWER. The complete operating cycle is in one motion and is driven through a compact mechanism by a non-reversing motor. When the operating shaft is rotated, the nozzle advances, the steam ports open and, at the same time, rocking motion is automatically transmitted to the nozzle. The uni-directional motor eliminates the bulky contactor gear used with reversing motors and reduces electrical maintenance by being of simpler and more rugged construction.

The reversing motion is achieved *mechanically* on all Lectramek blowers. A limit switch mounted on the gear box and connected to the starter regulates the stopping, starting and number of strokes.



AND THE CONTROL PANEL Simple controls to operate the automatic sequence are grouped on this small unit which takes up little space on the main boiler control panel.

CLYDE SOOT BLOWER EQUIPMENT

Further information is given in our publication No. CBL. 1954 which will be supplied on application.

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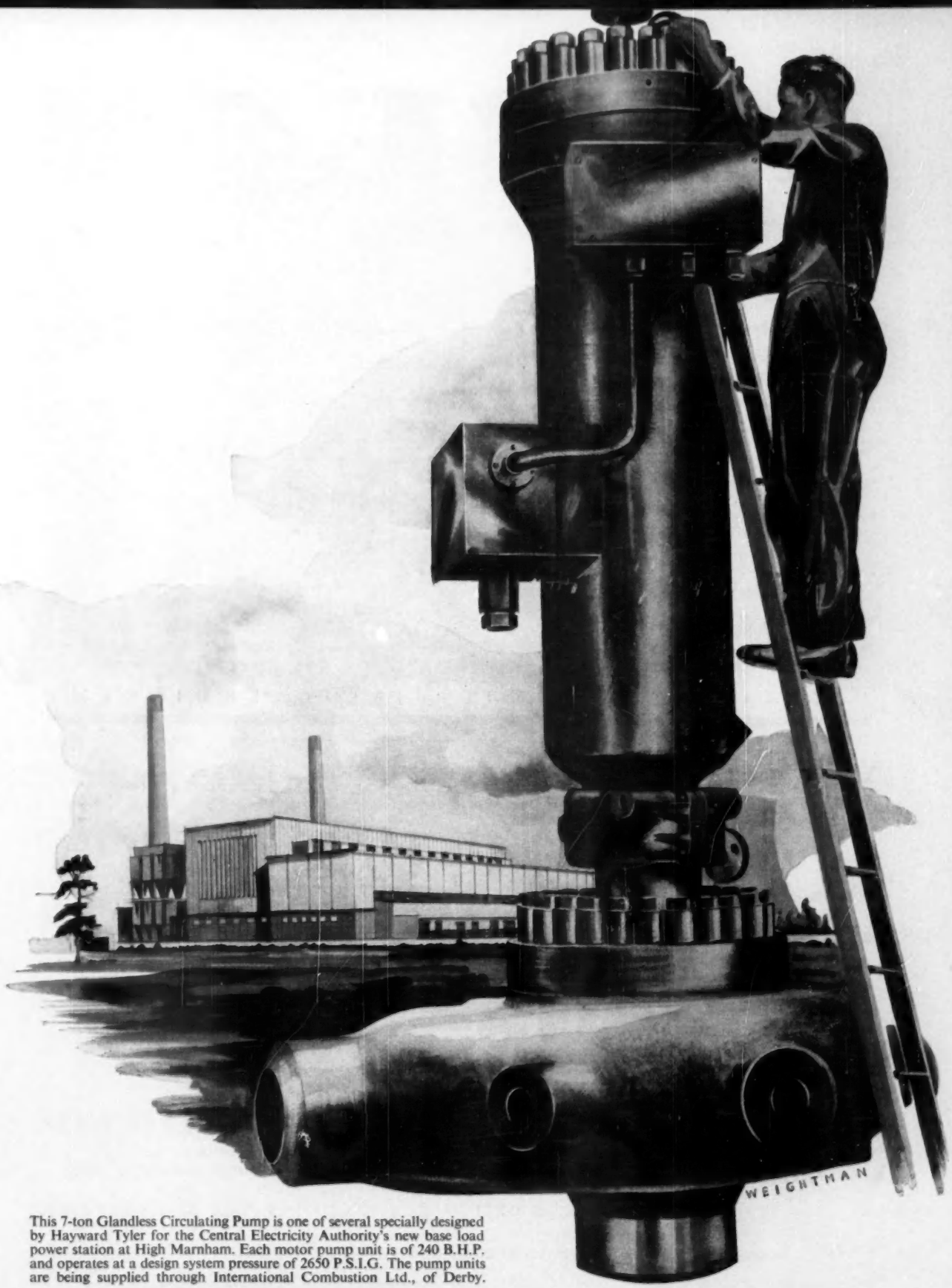
* *Over 5,000 blowers of this type in use all over the world.*



This 7-ton Glandless Circulating Pump is one of several specially designed by Hayward Tyler for the Central Electricity Authority's new base load power station at High Marnham. Each motor pump unit is of 240 B.H.P. and operates at a design system pressure of 2650 P.S.I.G. The pump units are being supplied through International Combustion Ltd., of Derby.

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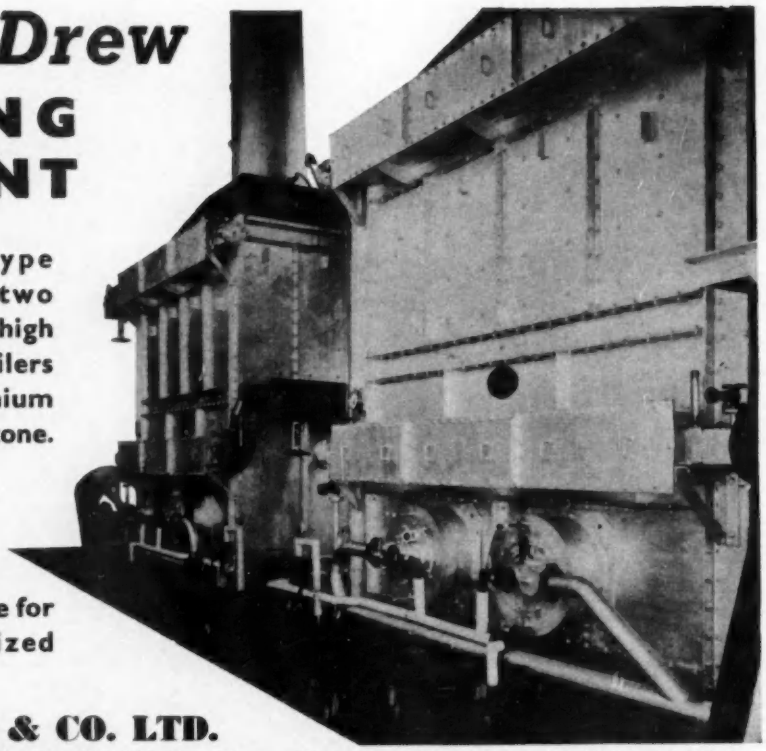

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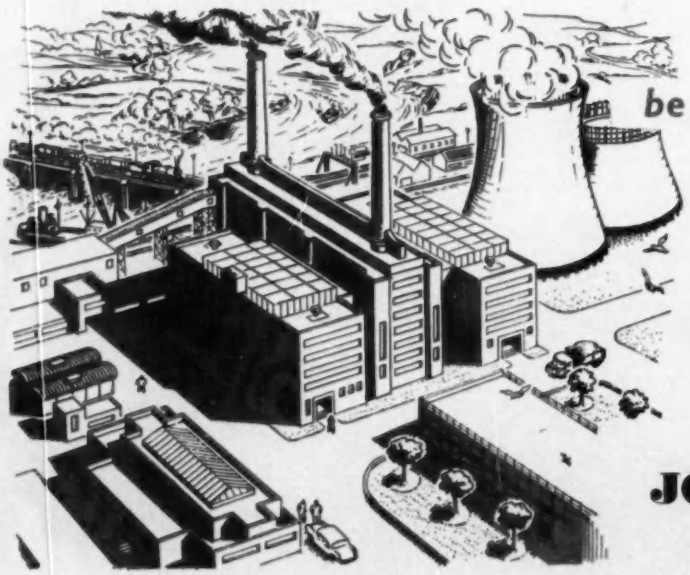

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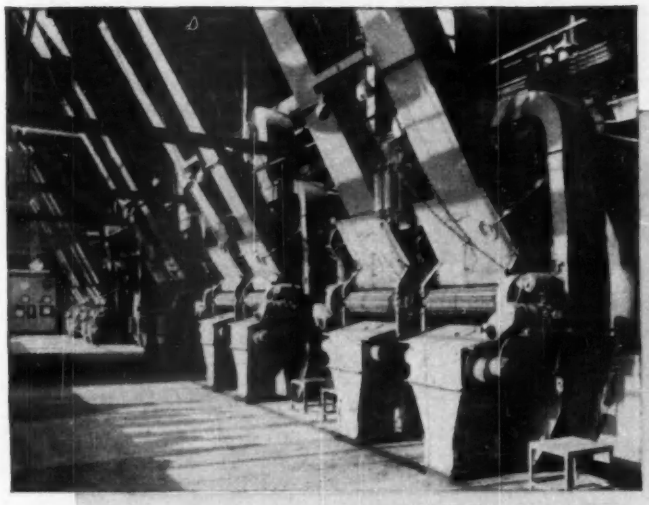

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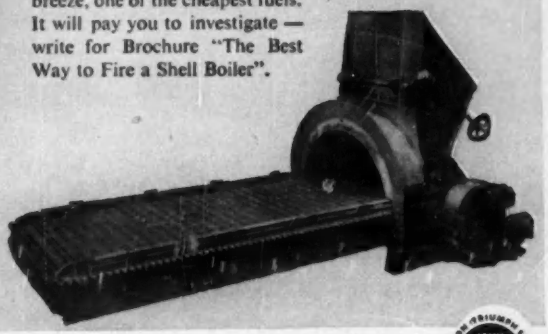

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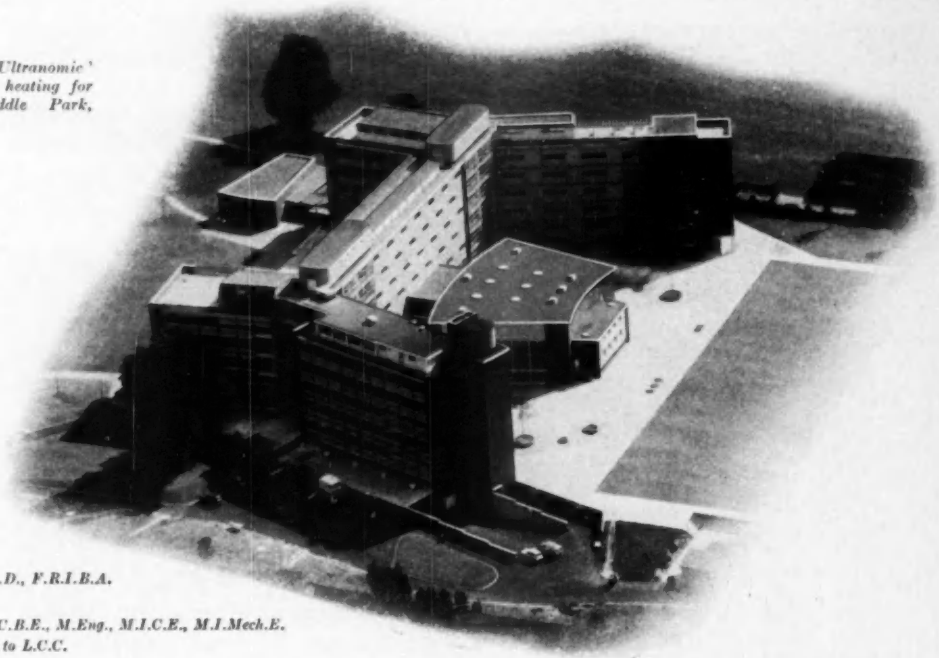

Two Paxman Double Pass 'Ultranomic' hot water heaters provide the heating for Eltham Green School, Middle Park, London, S.E.9.

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Architect to the L.C.C.

Heating Engineers: J. Rawlinson, C.B.E., M.Eng., M.I.C.E., M.I.Mech.E.
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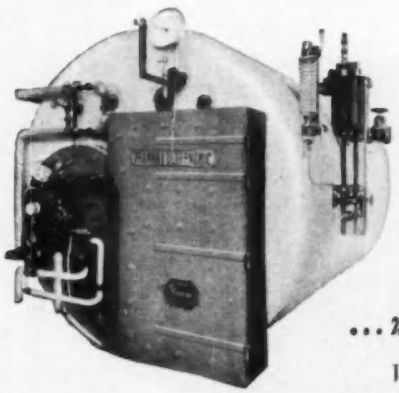

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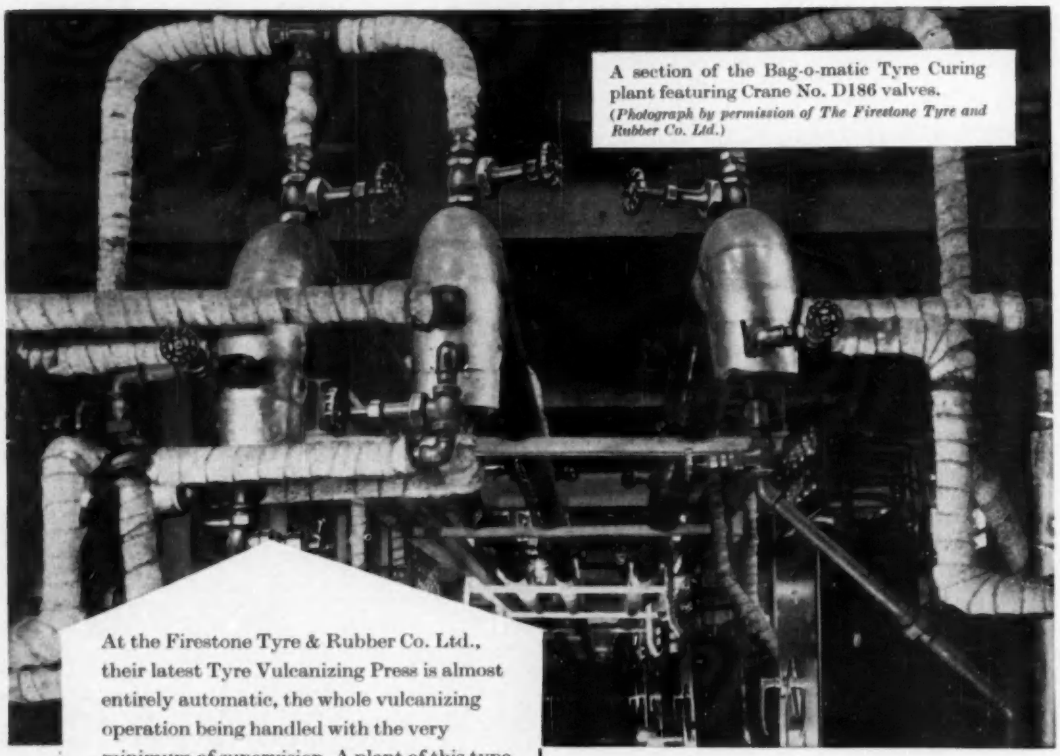
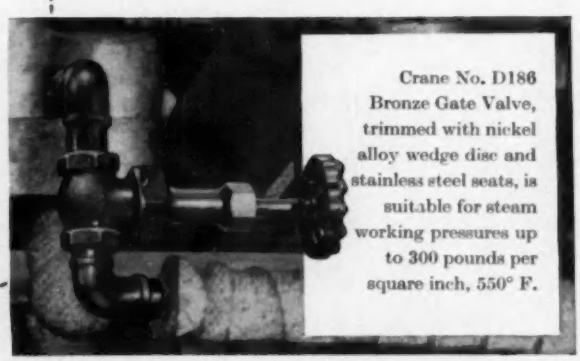


A section of the Bag-o-matic Tyre Curing plant featuring Crane No. D186 valves.
(Photograph by permission of The Firestone Tyre and Rubber Co. Ltd.)

At the Firestone Tyre & Rubber Co. Ltd., their latest Tyre Vulcanizing Press is almost entirely automatic, the whole vulcanizing operation being handled with the very minimum of supervision. A plant of this type must not be delayed due to valve failure, and naturally the Firestone engineers selected Crane valves to ensure a high standard of service and dependability. Their choice for this plant was the Crane No. D186 Bronze Gate Valve. Important features of this valve are that it has a union bonnet—a joint that is easily dismantled and reassembled, nickel alloy wedge disc and stainless steel seats. The confidence placed by engineers in Crane products is emphasised by this association with Firestone—for here Crane valves are playing an important part in one of the latest examples towards automation in industry.

Once again, valves by Crane



Crane No. D186 Bronze Gate Valve, trimmed with nickel alloy wedge disc and stainless steel seats, is suitable for steam working pressures up to 300 pounds per square inch, 550° F.

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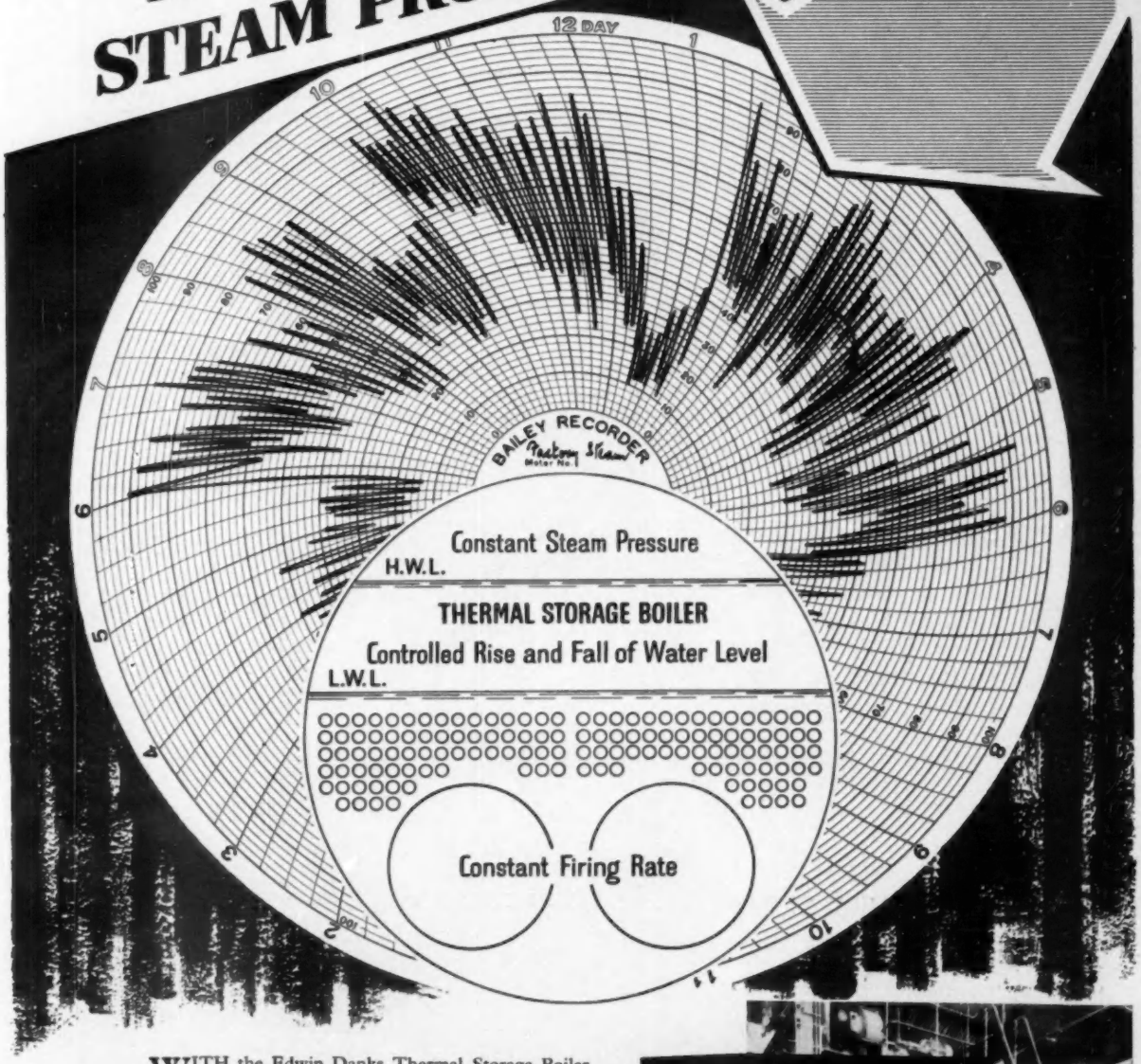

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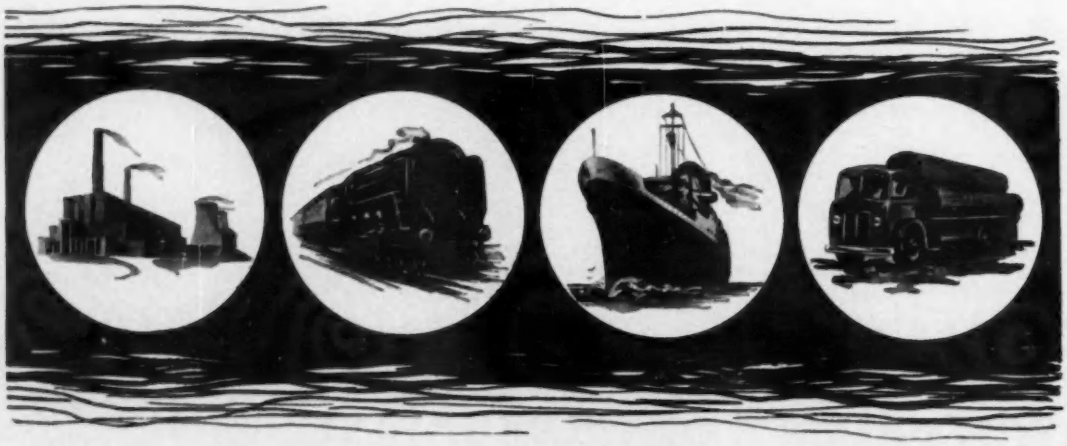

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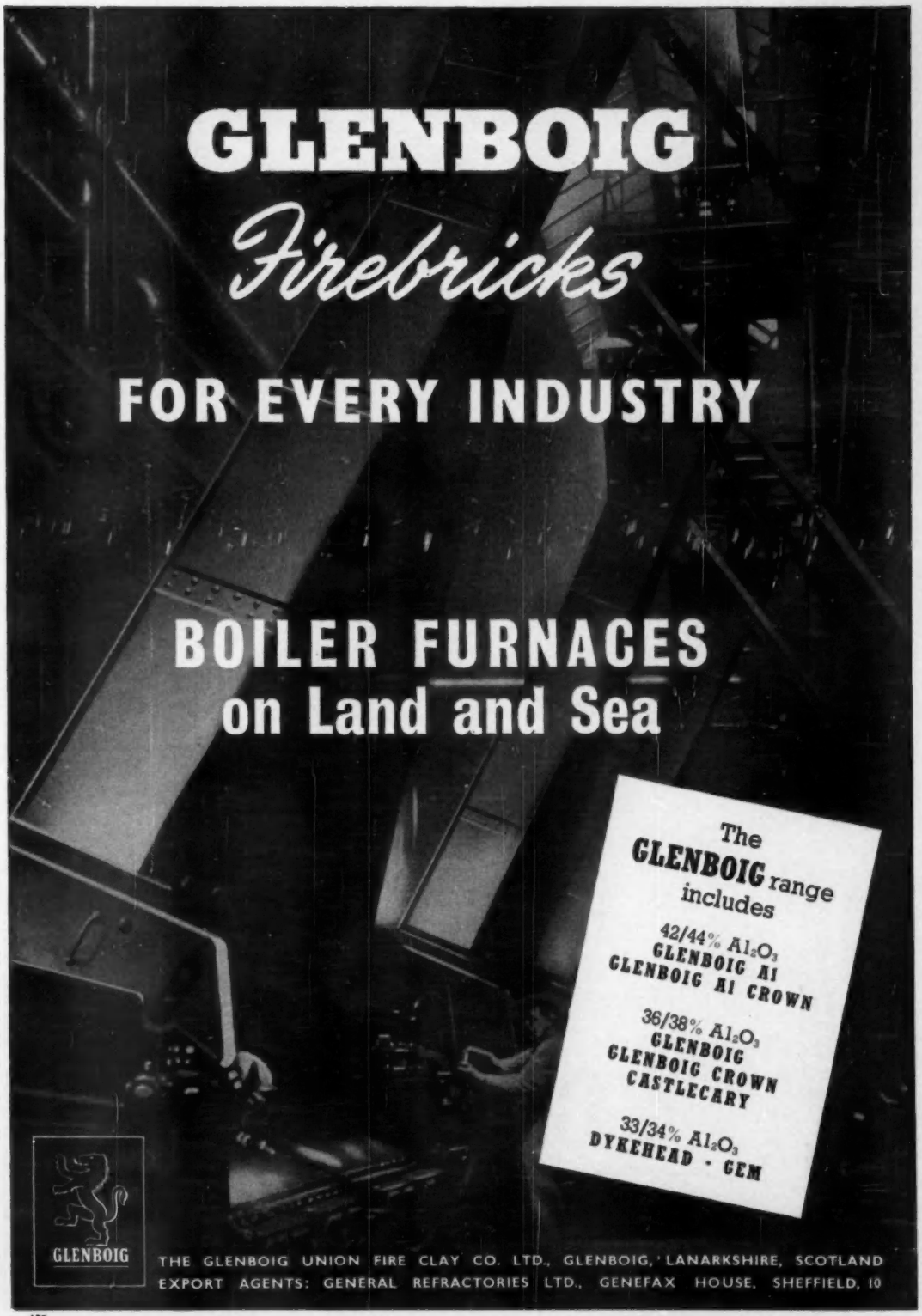
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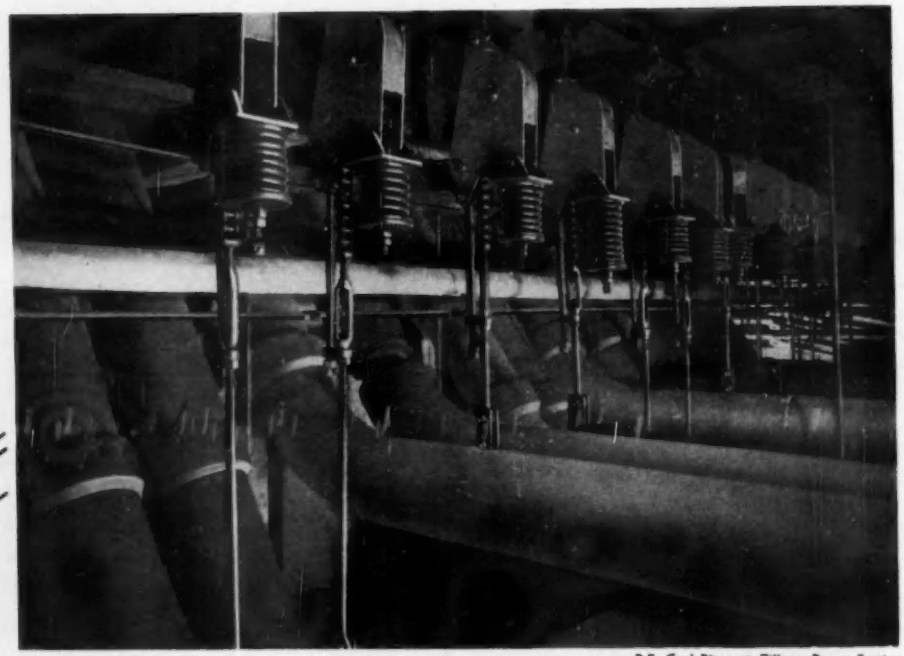

P.F. Coal Pipes at Tilbury Power Station
Photograph by courtesy of the C.E.A.

For loads up to 4 tons and pipe movements up to 18".

High-pressure steam piping is subject to wide variations in temperature, which produce considerable expansion and contraction. Unless the pipe supports can absorb and compensate for this movement, severe stresses are set up which may result in fracture. The " Con-Ten " Pipe Support is designed to cradle any type of piping with constant tension under all conditions, throughout the range of movement. " Con-Ten " is installed, with eminently satisfactory results, in power stations, oil refineries, chemical and industrial plants throughout the world.

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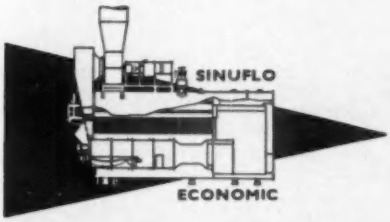
An 11′ 9″ diameter Cochran Sinuflo Economic boiler arriving at the factory of Thomas De La Rue (Aust.) Pty., Ltd., in Thornleigh, New SouthWales.

Here in Australia, as in the rest of the world, the particular features of this type of boiler are appreciated by the experienced user. Cochran Sinuflo Economic boilers are designed and built to give long service, *continuous* high efficiency, full accessibility to all water surfaces and convertibility from solid to liquid fuel-firing and vice versa.



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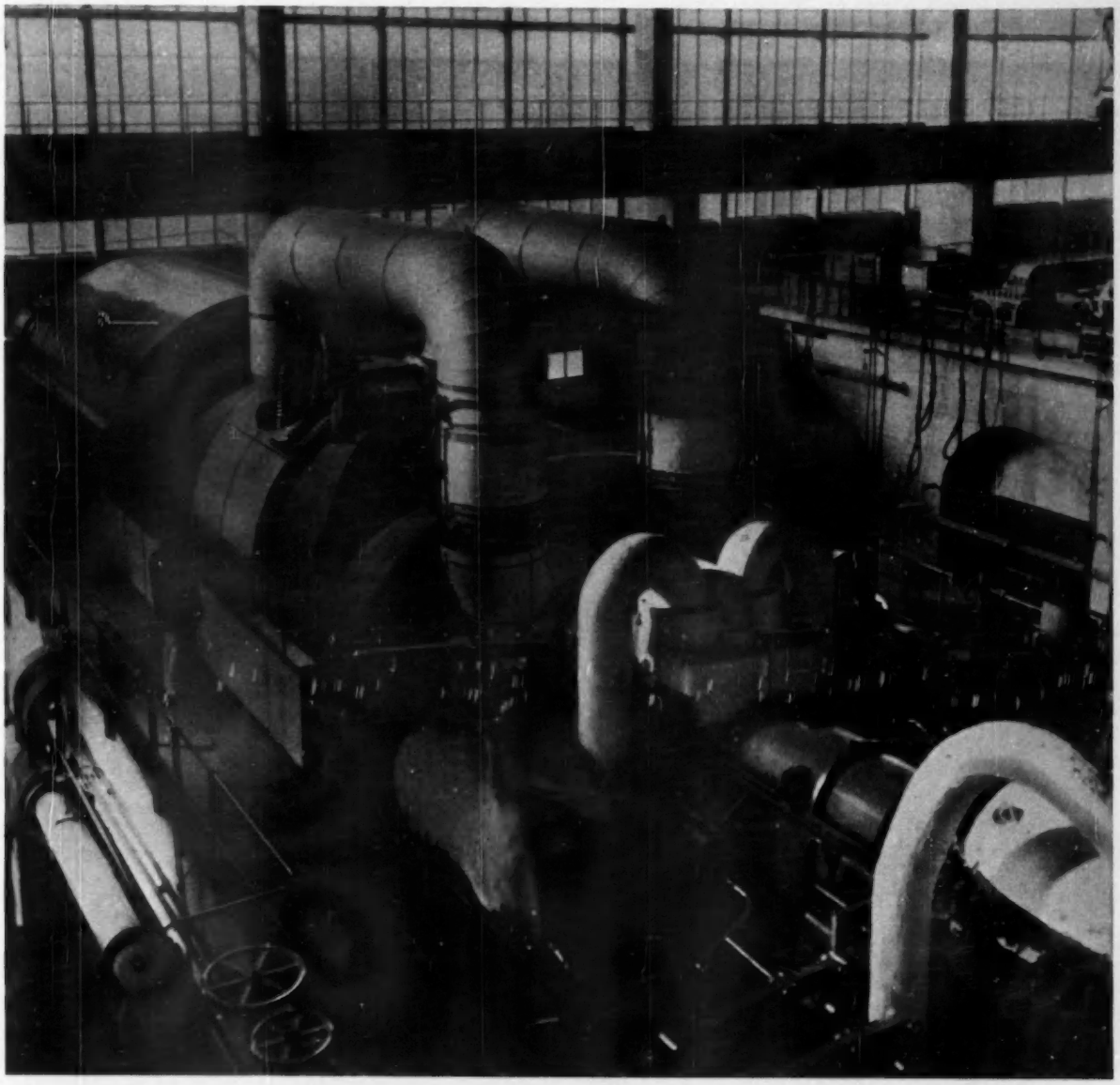


100 MW turbo-generators nearing completion

The installation of three PARSONS 100 MW turbo-generators is well under way at The Central Electricity Generating Board, Ferrybridge Power Station, Yorkshire. Here is the first machine nearing completion; it is now in operation. Steam conditions: 1500 lb/in² pressure, 975° F. temperature and reheat to 950° F.

PARSONS

TURBO-GENERATORS

C. A. PARSONS & COMPANY LIMITED · HEATON WORKS · NEWCASTLE UPON TYNE 6

"But why can't they use my magnet?"

"Well, you see Johnny, it's because *your* sort of magnet can't be switched 'on and off'!"

"*Huh! I wouldn't like mine to do that!*"

"I know, but then you don't use yours to control water or gas and things."

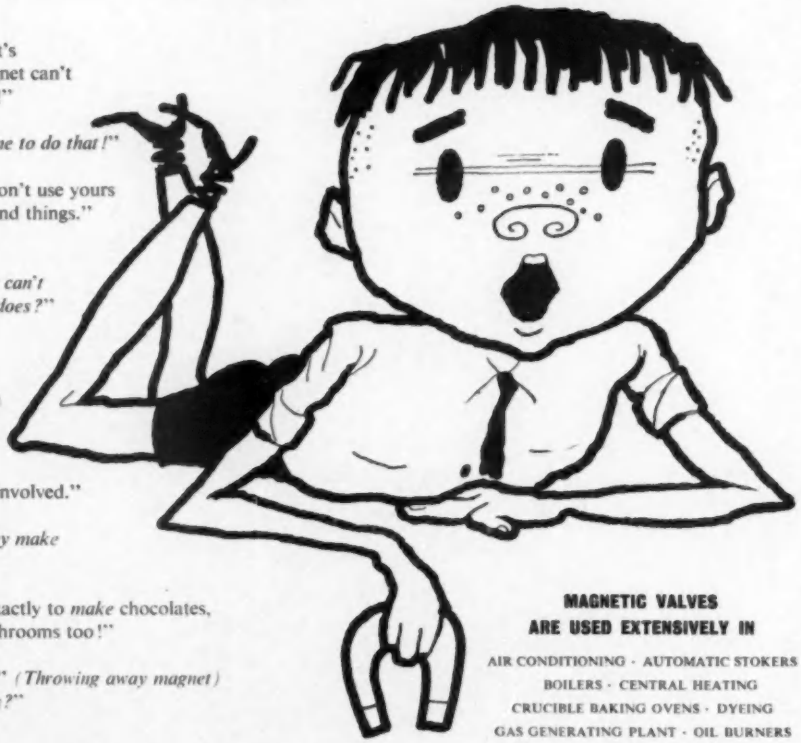
"*Control water or gas? Seems stupid to me—why can't they use a tap like Mum does?*"

"Ah! But using a tap means that you rely on what's called the 'human element'. That's why these valves are fitted to do things automatically —without people being involved."

"*Mr. Stevens told me they make chocolates with them!*"

"That's right, but not exactly to *make* chocolates, to *help* make them. Mushrooms too!"

"*Cor! I like mushrooms.*" *(Throwing away magnet)* "*Can I have some for tea?*"



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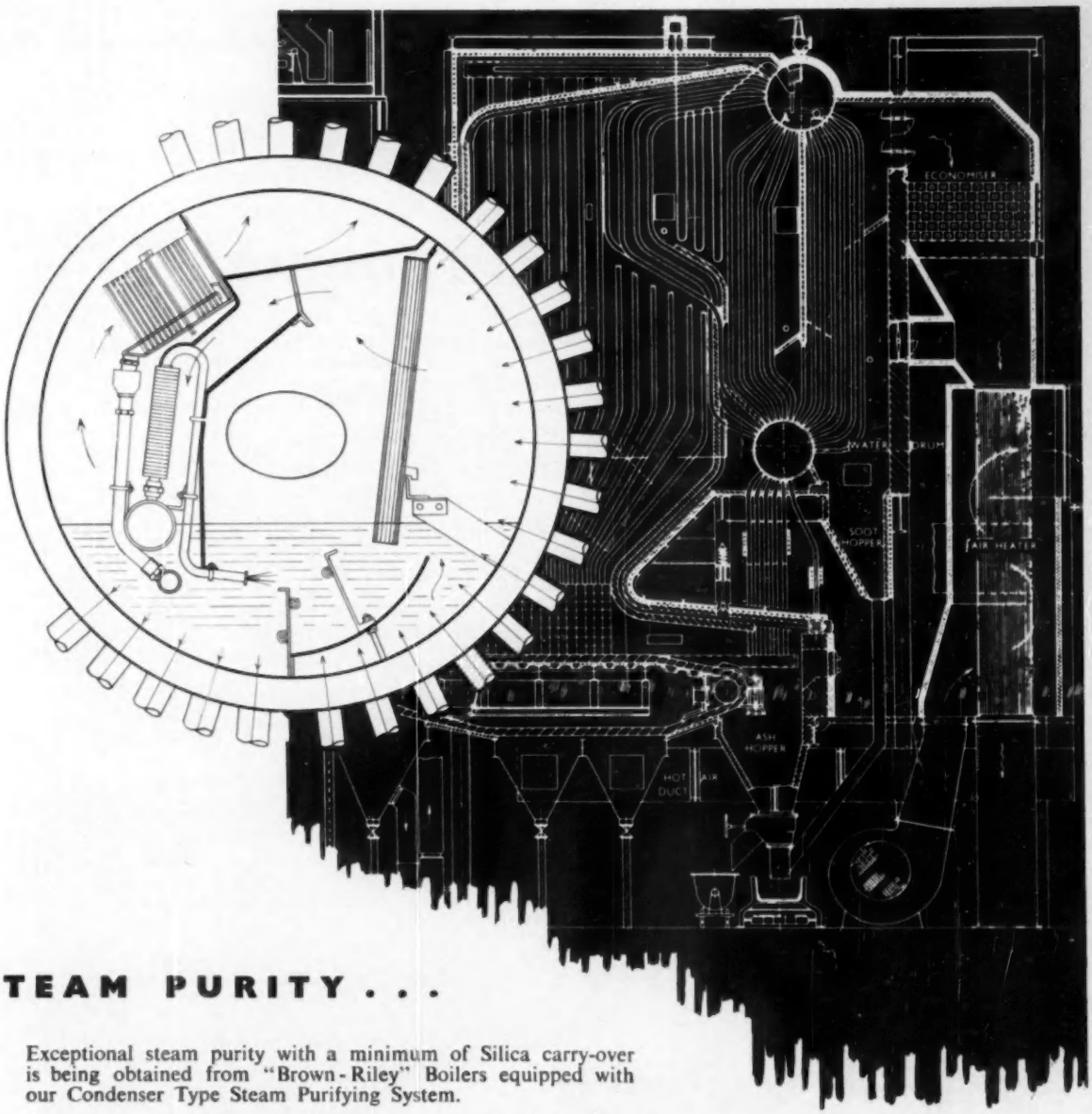

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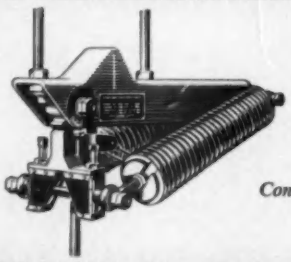

Vokes Genspring Constant Support Hanger

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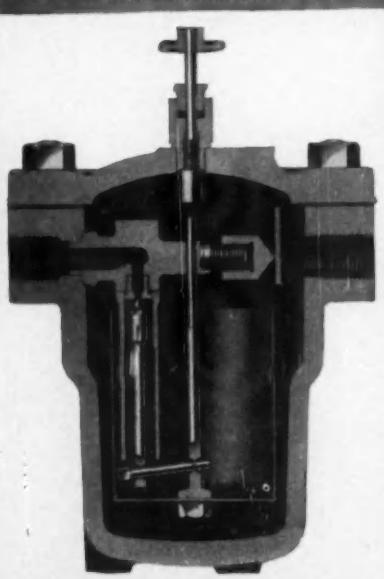

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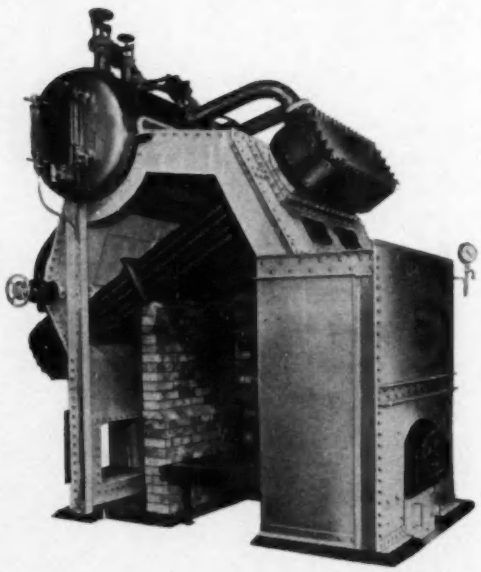

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note the common factor... TRI-MOR*

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* **TRI-MOR** *is the generic name for the castable and mouldable refractories manufactured by Morgan Refractories Ltd.*

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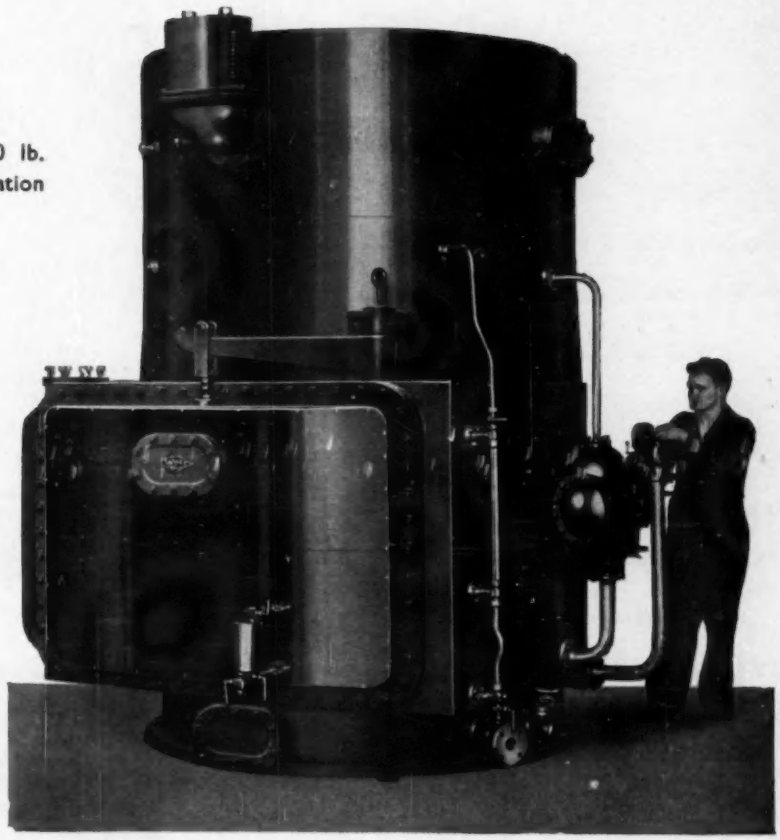

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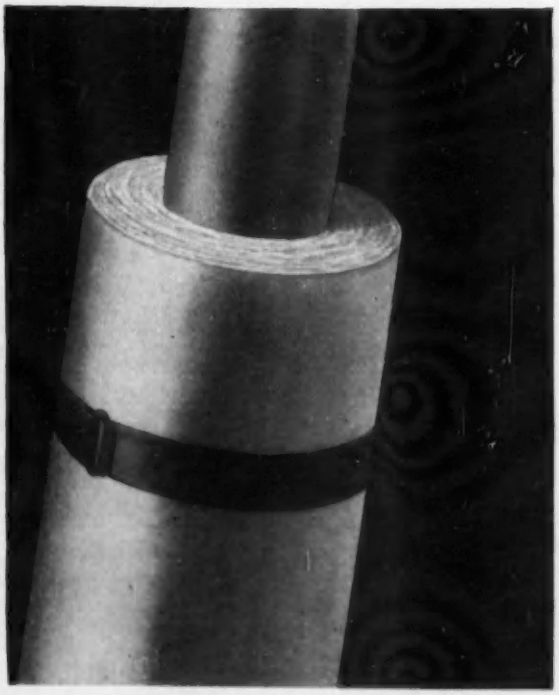
I used to work naked as the day I was drawn. Of course I wasted heat—and therefore fuel—but who cared? Then one day, a bright spark from Fibreglass told the Manager that I was wasting nearly one ton of coal a year through each foot of my length.

I felt naked—and ashamed. Quickly they had me wrapped in a Fibreglass rigid section 1½" thick. Now, this is saving 18½ cwts. of each ton I used to waste. My conscience is clear; but if pride is a sin, I'd better look out. Because I *am* proud of my slim figure, my neat nesting and my light-weight on hangers."



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THE OLDEST ESTABLISHED STEAM ENGINEERING PUBLICATION

FEBRUARY 1958

VOLUME 73. No. 2

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The Editor will be glad to receive and consider original contributions, correspondence, etc., of a suitable nature for publication. Stamped and addressed envelopes should be enclosed for the return of any matter considered unsuitable

Published monthly by

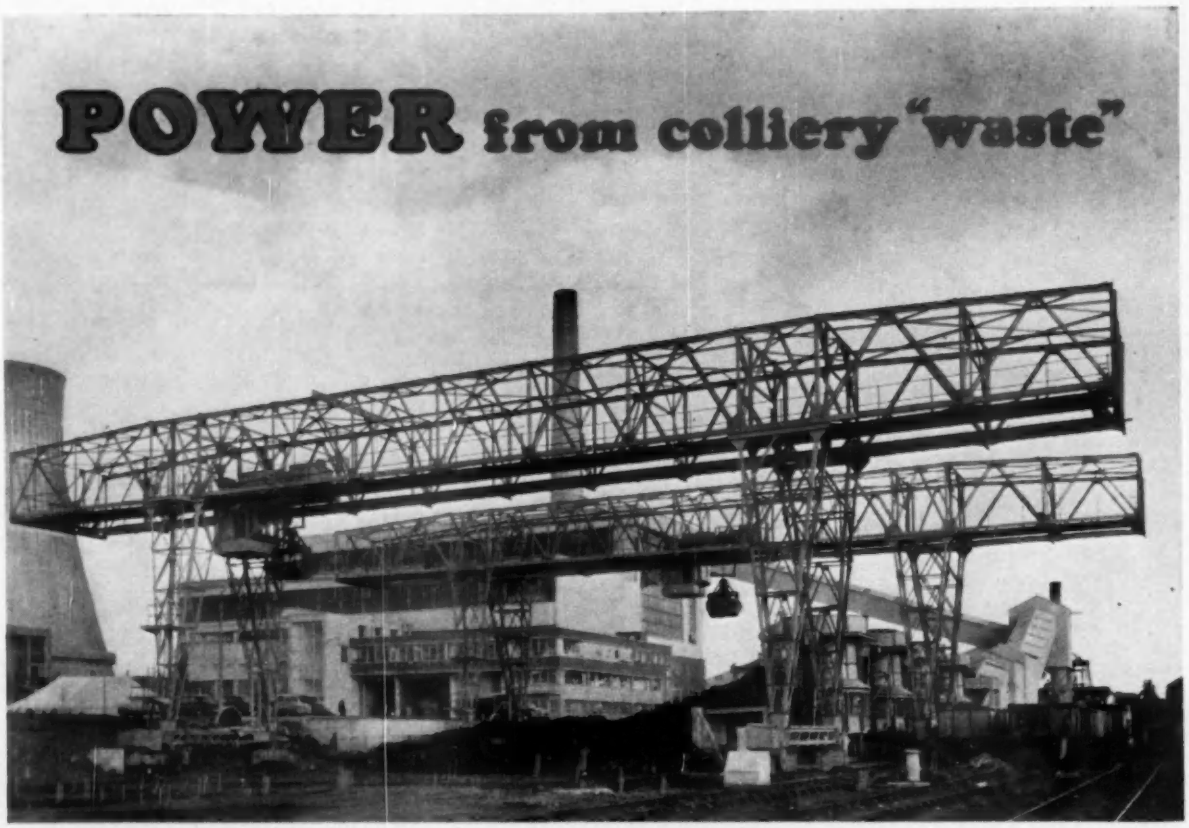
ENGINEERING REVIEW PUBLISHING CO. LTD.
19-20, NOEL STREET, LONDON, W.1

Annual Subscription Rate, 40s., including postage.

Telephone
Gerrard 8811

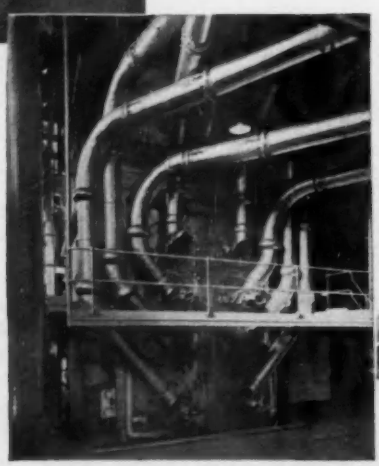
Telegrams
"Farsighted, Wesdo London"

POWER from colliery "waste"



Barony power station, showing Babcock cranes, rotary hoppers and fuel conveyor system.

Line of Babcock rotary hoppers for handling slurry to the drying and pulverizing mills feeding the boilers.



P.F. burners and fuel piping on one of the boilers.

The whole of the boiler plant for the new Barony power station (South of Scotland Electricity Board), comprising four 150,000 lb./hr. pulverized-coal-fired boilers, and the whole of the coal and ash handling equipment, are of BABCOCK design and manufacture.

Outstanding feature of this installation is its ability to use as fuel, "washery-slurry"— a wet, putty-like and previously unusable by-product of the coal-washing plants.

This has been made possible through the development by Babcock & Wilcox of new, economic methods and equipment for the handling and preparation of "washery-slurry" for use as a boiler fuel — one of many BABCOCK contributions to national fuel economy.

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Engineering and
BOILER HOUSE REVIEW

FEBRUARY 1958

VOLUME 73 No. 2

THE STEEL INDUSTRY

DURING the opening weeks of each year the annual general meetings of the principal steel companies are usually held. Last month about half a dozen took place—including the meetings of two of the largest companies. The chairmen of The United Steel Companies Limited, of Dorman Long & Company Limited, and of Stewarts and Lloyds Limited, in their statements to the shareholders, all warned the Labour Party to "leave well alone" and keep off de-nationalised industries.

In a forceful statement to the shareholders of The United Steel Companies, at their meeting held at The Iron and Steel Institute, in London, on January 30th, the chairman, Sir Walter Benton Jones, Bt., devoted a large proportion of his statement to the question of nationalisation, and declared the opposition of his board "to any further interference with ownership or management of the steel industry." The industry has, it will be remembered, previously been nationalised and it has been de-nationalised; now the Socialist Party say it should be re-nationalised, or in other words, to restore public ownership in the steel industry. As Sir Walter Benton Jones pointed out—on its merits it is doubtful whether anyone wants to "nationalise steel": neither the proprietors, nor men employed in making it, nor the people who buy it—particularly when it is remembered that steel is not just the conversion of iron ore into something which the man in the street calls steel and which in its primary state he has never seen. The companies and operatives who make steel pass it on to be worked up into innumerable components for an exceedingly wide range of purposes. Thus, steel cannot be nationalised in isolation. In the nature of things, undertakings which manufacture steel must usually fashion it into many finished or semi-finished products. The steel industry then is not a service but a manufacturing and trading industry which directly and indirectly produces a large proportion of the things which this country exports.

It provides a large proportion of the exchange currency with which we pay for our imports and for which we depend on for our living to a greater extent than any other major country in the world.

Certainly the industry is highly organised in every branch, and is co-ordinated by means of a central organisation presided over by an independent chairman. Sir Walter Benton Jones said that if a finger is pointed to the existing nationalised industries, whether to have nationalised them has been beneficial or otherwise to this country may still be a matter of opinion. But in the conduct of them, it has been demonstrated in almost every case, that when nationalised they soon wear political clothes. The Acts by which they were nationalised provide management machinery which it was claimed would make them free of political interference. But in practice it has been found that what is their business becomes the business of Parliament. But the steel industry is very different from the nationalised industries. It is a manufacturing and trading activity. The nationalised coal mines, railways, electricity industry and gas industry are services which to some extent are domestic matters, although their efficiency is reflected in the cost of everything we make for ourselves and the cost of everything we sell abroad. But steel is a commodity which is bought and sold at home and in the markets of the world, where it is regarded as being one of our most important mediums of exchange. Many eminent industrialists point out that it is against the interest of both home and export markets that the making of steel, the distribution of steel and the sale of steel should become the property and monopoly of the state. Furthermore, there is no reason to nationalise the industry because when it was de-nationalised, Parliament set up an Iron and Steel Board to exercise a general supervision over the industry.

From remarks made by the chairmen of the other companies, the future is viewed with somewhat mixed feelings, despite last year's excellent results. They all seem to anticipate a slackening in the "hitherto overwhelming world-wide demand for steel," and express some doubt what the position may look like a few months hence if monetary restrictions are enforced to a point where industrial production suffers or is only maintained by reduction in stocks.

Points and Pointers

GREATER USE OF INDUSTRIAL INSTRUMENTS FORESEEN

The number of small, inefficient, manually-operated plants would become gradually fewer; and as firms became larger and amalgamations occurred, the drive for industrial instruments and their better use would go forward, said Mr. S. P. Chambers, C.B., C.I.E., senior deputy chairman of Imperial Chemical Industries Ltd., at the annual luncheon of "BIMCAM" (British Industrial Measuring & Control Apparatus Manufacturers' Association) in London, on January 7th. He mentioned Sir Alexander Fleck's report that the Windscale incident would never have happened if there had been better understanding of the instrument equipment and if the instruments had been more conveniently placed. Instruments were of little value in any plant unless adequately trained staff were available to install and use them properly. Mr. E. W. Wilson, chairman of BIMCAM, referred to the export record of the association for 1957, in which it was expected that exports would exceed £15 million out of a total turnover of £35 million. He stressed that home trade was the basis of export sales, and expressed the hope that this basis would expand with the anticipated increase of the export market when the European Free Trade Area came into being. Mr. Wilson announced that the Instruments, Electronics and Automation Exhibition in April would be 50 per cent. larger than the previous exhibition and would, for the first time, be international. Mr. L. S. Yoxall, president of BIMCAM, proposed the toast of the guests and introduced the responder, Mr. T. E. Goldup, the president of the Institution of Electrical Engineers. Mr. Goldup referred to measurement and control as the most important factor of today in industry. The country could not progress unless the continual changes occurring in industry could be measured and then controlled. There was also the need for men who could read the instruments intelligently. Mr. Goldup also made reference to the appalling shortage in this country of technical manpower at all levels, and this was perhaps the greatest limitation on industrial progress.

FIRST FLECK REPORT ON WINDSCALE

The White Paper (Cmnd 338) on the organisation of the United Kingdom Atomic Energy Authority was published recently. The report is by the first of three committees appointed by the Prime Minister under the common chairmanship of Sir Alexander Fleck, following the Windscale accident in October last. Broadly, the recommendations involve the creation of a number of new senior technical posts in the Industrial Group of the Authority, and the report goes on to say that these recommendations may involve the curtailment of some of the Authority's work in other directions. The weakness in the present organisation of the Industrial Group comes primarily, in the opinion of the committee, from a lack of senior technical staff on the operation side, that is the part of the Industrial Group dealing with established plants like Windscale, Calder Hall and Capenhurst and which will soon have Chapelcross and Dounreay added to them. The committee consider that the pressure on the resources of the group have been too severe and that the Authority's development effort must be centred on fewer projects to provide the necessary switch in manpower. Such are the consequences of the present national shortage of highly qualified technical staff. The report recommends the appointment of two deputy managing directors to the Industrial Group to assist the managing director, all three being substantially free from routine work. They also recommend that the board of management should include a temporary director for bringing about liaison with the other groups and with external organisations. There are certain recommendations about the staffing of the branches and the headquarters unit. The conclusions of the White Paper, briefly stated, are that the organisational weakness of the U.K.A.E.A. Industrial Group stems "primarily and noticeably from an insufficiency of senior technical staff," and that to correct this situation a number of new senior technical posts will have to be created. "Where the men to fill these posts will come from," says the report, "is a matter for the Authority." It is considered that unless substantial recruitment of high-quality staff is successful, strengthening of the Operations Branch at a lower level will be necessary at the expense of some work at present under way elsewhere in the Authority. But this work must not be wasted, it is acknowledged, and since "panic measures" are not required, "the necessary transfer of staff can only take place with due deliberation over a period of time."

COURSE FOR WORKS AND PLANT ENGINEERS

A Third Residential Course for works and plant engineers has been organised by The Regional Council for Further Education for the South West in collaboration with the Somerset Local Education Committee and the National Industrial Fuel Efficiency Service, and will be held at The Grand Central Hotel, Weston-super-Mare, from March 24th to 29th, 1958. The idea of this six-day refresher course is to provide an opportunity for technical staff of industrial firms and other large steam users and steam plant operators to obtain up-to-date information on recent developments in the efficient use of heat and power. The scope of the course is extensive, as nearly twenty lectures are included in the programme. These lectures will cover such subjects as solid and liquid fuels, the selection and operation of boiler plant, steam generation and utilisation, feedwater, instrumentation, insulation, nuclear energy and heating systems. Each lecture will

be given by an expert, and particular attention will be paid to current practice and possible future developments. Synopses of the various lectures will be issued to members of the course, and many lectures will be supported by films and other illustrative material. A visit to an industrial installation has been included. Time will be allowed for questions and discussion outside the lecture programme. Details of the programme have been worked out by a panel of the Fuel Technology Advisory Committee of the Regional Council under the chairmanship of Mr. H. Kinsey, M.Inst.F., area engineer of the National Industrial Fuel Efficiency Service, who will also act as course director. His Worship the Mayor of Weston-super-Mare will attend the opening session. The registration fee covering the whole course, meals and accommodation will be £12 12s. Course, coffee, lunch and tea only, will be £7 7s. Registration should be made by sending the appropriate application form to the Secretary, Regional Council for Further Education for the South West, 12, Lower Castle Street, Bristol, 1, not later than February 14th, 1948, together with a remittance for the appropriate fees. Cheques should be made payable to " The Regional Council for Further Education for the South West." A detailed brochure will be sent to each registered member as soon as possible after February 14th, 1958.

EXAMINATIONS IN TURBINE PLANT OPERATION

In a recent issue of the " Broadsheet " which we have received from the City and Guilds of London Institute, Gresham College, Basinghall Street, London, E.C.2, it is pointed out that regulations and a syllabus for examinations in steam turbine plant operation have been drawn up. They are included in the Institute's programmes for 1957-58 (Programme A) obtainable from the Institute at 4s. 6d. a copy. The examination consists of a written paper, and a practical/oral test which is carried out in a turbine house. The practical/oral test will be carried out by local examiners appointed by the Institute. Candidates who are successful in both parts of the examination will be awarded a pass certificate and details of the type of plant on which the practical/oral test was taken will be endorsed on this certificate. The syllabus includes sections on properties of steam, steam utilisation, steam turbine plant, turbine plant auxiliaries, turbine-driven plant, turbine plant operation, instrumentation, turbine plant efficiency and log records. The first main examination is to be held in May next, but a special examination for Central Electricity Authority employees was held last October. Copies of the question paper used for this examination may be obtained from the Institute (6d. each).

FIFTIETH ANNIVERSARY OF THE LORD KELVIN'S DEATH

Fifty years ago, on December 17th, 1907, William Thomson, Lord Kelvin, died at his home at Netherhall, Largs. One of the most distinguished physicists of all time, he made an enormous contribution to the progress of applied science, mathematics and natural philosophy. While probably his greatest contribution was to the science of thermodynamics, he was famed for his inventions, particularly in the navigational field. To Lord Kelvin is credited the design and effectiveness of the marine magnetic compass as we know it today ; the invention of the marine mechanical depth-sounder and, with the advent of the electric telegraph in 1837, it was William Thomson who solved the problems connected with the early failure of the Atlantic submarine cable. For this work he received a knighthood from Queen Victoria. He made fundamental contributions to the science of precise measurement and to him is also credited the invention of the galvanometer and the first portable electrometer. William Thomson was born in Belfast, the second son of James Thomson, who was professor of mathematics in the City's Royal Academical Institution. In 1832 the family moved their residence to Glasgow where James Thomson had been appointed to the chair of mathematics at the University. William was already showing signs of an alert and inventive mind. He matriculated at the age of ten and at the age of seventeen published his first original paper. He entered Peterhouse College, Cambridge, to read for the Mathematical Tripos, in which he graduated Second Wrangler as well as taking first place for the Smith Prizes. He afterwards studied in Paris where Regnault and Biot were transforming physics from a branch of natural philosophy into a practical science, and later returned to Cambridge to take up a Foundation Fellowship and Lectureship. In 1846, the chair of natural philosophy in the University of Glasgow became vacant, and Thomson, then only twenty-two, was elected and remained there for fifty-three years. He received a knighthood in 1866, and a barony—Kelvin of Largs—in 1892. In 1902 he was made a member of the Privy Council and in the same year became one of the first recipients of the Order of Merit. Lord Kelvin is buried in Westminster Abbey—his tomb adjoining that of Sir Isaac Newton—and where a memorial window has been erected to his memory. William Thomson was one of those rare paradoxes, a brilliant man intellectually, possessed of a good business acumen. He commercialised many of his seventy patents, and founded the firm of Thomson and James White in 1890. In 1900 the firm became a limited liability company under the name Kelvin & James White Ltd. On Lord Kelvin's death in 1907 he was succeeded by his nephew, Dr. Bottomley, as chairman. The name of the company was changed to Kelvin, Bottomley & Baird Ltd., in 1913. This enterprise continued to expand, and during the second World War became associated with Henry Hughes and Son Ltd. From this association came an amalgamation of the two companies under the name Kelvin & Hughes Ltd. Thus, Lord Kelvin's name is perpetuated today in the title of a company which continues to make expanding contributions in the field of scientific instruments and benefits together with many other branches of science and industry. On the industrial side, Kelvin & Hughes (Industrial) Ltd., as specialists in the design of industrial instruments, are well known as manufacturers of flow-meters, draught-gauges, temperature indicators, pneumercators, flue-gas analysers, lossmeters, electronic-controllers (which keep an accurate and selective control over process temperatures, enabling the smaller industrial organisation to reap the benefit of sensitive control without adding to normal maintenance personnel) and many other items of boiler plant instrumentation designed for use in the largest of industrial and process power installations.

POWER PLANT ENGINEERING

during 1957

THE most important event affecting the electricity supply industry last year was undoubtedly the passing of the Electricity Act, 1957. The Act, which became effective on January 1st, 1958, resulted in numerous far-reaching changes in administration. In the January, 1958, issue of this journal reference was made to the re-organised structure of the industry under the provisions of the Act.

The brief history of the nationalised industry stems from the Electricity Act, 1947, when the British Electricity Authority was established, together with fourteen area boards to co-ordinate the supply of electricity throughout Great Britain, with the exception of an area controlled by the North of Scotland Hydro Electric Board. At Vesting Day, April 1st, 1948, the Authority became responsible for some 541 supply undertakings, and with the status of a statutory corporation, comprising members appointed by the Minister of Fuel and Power, became both owner and operator of the power stations previously administered by these undertakings, together with the main transmission lines and switching station that formed the interconnected network known as the Grid. The Authority exercised a general control over the area boards, to which they supplied electricity in bulk for sale and distribution to consumers. Under the B.E.A. the country was divided into fourteen Generating Divisions whose areas correspond in general to those of the area boards. This number was, however, reduced to thirteen on April 1st, 1954, when the Merseyside and North Wales Division and the North Western Division were amalgamated to form the North West, Merseyside and North Wales Division.

The next important administrative change came into effect on April 1st, 1955, when, under the Electricity Reorganisation (Scotland) Act, 1954, the Authority's undertakings in Scotland (the South East and South West Scotland Generating Divisions) and the undertakings of the South East and South West Scotland Area Boards were vested in a new public authority, the South of Scotland Electricity Board. At the same time the title of the British Electricity Authority was changed to Central Electricity Authority, the number of area boards was reduced to twelve, and the generating divisions to eleven. Agreements between the South of Scotland Electricity Board and the C.E.A., made at the time of this reorganisation, ensured that the main transmission facilities taken over by the Board should continue to operate interconnected with the remainder of the grid system, and that transfers of electricity between England and Scotland should continue to be arranged in accordance with the principle that at all times the overall cost of generation should be kept as low as possible.

STEAM GENERATING PLANT COMMISSIONED BY C.E.A. DURING 1957

Name of Power Station	C.E.A. Division	Turbo-alternator Plant		Boiler Plant	
		Installed capacity (MW)	Maker	Capacity in lb./hr.	Maker
Steam Plant					
Acton Lane "B"	London	2 x 30	Richardsons, Westgarth	2 x 240,000	Mitchell Eng. Ltd.
Barking "C"	London	—	—	1 x 540,000	Babcock & Wilcox Ltd.
Bold "A"	N. West, Merseyside & N. Wales	—	—	1 x 300,000	Yarrow & Co. Ltd.
Brighton "B"	South Eastern	1 x 60	Richardsons, Westgarth	2 x 320,000	†Babcock & Wilcox Ltd.
Carmarthen Bay	South Wales	—	—	1 x 240,000	Babcock & Wilcox Ltd.
Castle Donington	East Midlands	3 x 100	Metropolitan-Vickers	2 x 830,000	Babcock & Wilcox Ltd.
Chadderton "B"	N. West, Merseyside & N. Wales	1 x 60	Metropolitan-Vickers	2 x 360,000	Simon-Carves Ltd.
Connah's Quay	N. West, Merseyside & N. Wales	1 x 30	C. A. Parsons	1 x 300,000	International Combustion Ltd.
Deptford East H.P.	London	1 x 52.5	Metropolitan-Vickers	—	—
East Yelland	South Western	1 x 31	C. A. Parsons	1 x 180,000	John Thompson (Water Tube Boilers) Ltd.
*Ferrybridge "B"	Yorkshire	1 x 100	C. A. Parsons	1 x 760,000	Stirling Boiler/Babcock & Wilcox Ltd.
Goldington	Eastern	1 x 30	British Thomson-Houston	1 x 300,000	Clarke, Chapman & Co. Ltd.
Hackney "B"	London	1 x 30	C. A. Parsons	1 x 300,000	Simon-Carves Ltd.
Hams Hall "C"	Midlands	3 x 60	General Electric Co.	3 x 550,000	Simon-Carves Ltd.
Huncoat	N. West, Merseyside & N. Wales	1 x 30	General Electric Co.	1 x 305,000	Simon-Carves Ltd.
Lincoln	East Midlands	2 x 20	Brush	4 x 120,000	Richardsons, Westgarth (Hartlepool) Ltd.
Marchwood	Southern	1 x 60	English Electric Co.	1 x 550,000	John Thompson (Water Tube Boilers) Ltd.
Meaford "B"	Midlands	2 x 60	British Thomson-Houston	1 x 515,000	Babcock & Wilcox Ltd.
Mexborough	Yorkshire	2 x 30	English Electric Co.	3 x 180,000	Richardsons, Westgarth (Hartlepool) Ltd.
Nottingham H.P.	East Midlands	1 x 60	Metropolitan-Vickers	1 x 300,000	Mitchell Eng. Ltd.
Ocker Hill	Midlands	—	—	1 x 180,000	Babcock & Wilcox Ltd.
Portishead "B"	South Western	2 x 65	Metropolitan-Vickers	3 x 300,000	Mitchell Eng. Ltd.
*Rogerstone	South Wales	2 x 60	C. A. Parsons	2 x 550,000	Babcock & Wilcox Ltd.
*South Denes	Eastern	1 x 60	Metropolitan-Vickers	1 x 550,000	International Combustion Ltd.
Tilbury "A"	Eastern	2 x 60	C. A. Parsons	2 x 540,000	John Thompson (Water Tube Boilers) Ltd.
Wakefield "B"	Yorkshire	1 x 60	English Electric Co.	1 x 550,000	Foster Wheeler Ltd.
*Willington "A"	East Midlands	1 x 100	English Electric Co.	1 x 830,000	International Combustion Ltd.
27 stations including 4 new stations	11 Divisions	34 turbo-alternators having an aggregate installed capacity of 1,893.5-MW		41 boilers having an aggregate installed capacity of 15,950,000 lb./hr.	

*New stations in which plant was commissioned for the first time during 1957

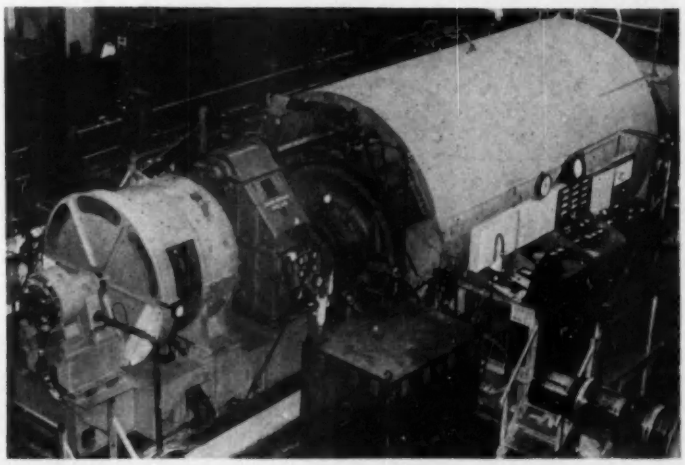
In 1954, six years after Vesting Date, the Government set up a committee under the chairmanship of Sir Edwin Herbert to enquire into the organisation and efficiency of the electricity supply industry in England and Wales, and it was upon the recommendations of the Herbert Committee that the Electricity Act, 1957, was based. It provided for the dissolution of the Central Electricity Authority, and for the taking over of the responsibilities of that organisation by two new bodies—the Electricity Council and the Central Electricity Generating Board.

The membership of the Electricity Council comprises a chairman, two deputy chairmen, and numbers among its members the chairman and two other members of the Central Electricity Generating Board, and the chairmen of the twelve area boards. The main functions of the Council are to advise the Minister on matters concerning the supply industry; to promote and assist the maintenance and development by the area boards of an efficient, co-ordinated and economical system of electricity supply; and to scrutinise and advise on the area board's programmes of capital expenditure. The Council is also responsible, on behalf of the industry as a whole, for certain common services such as research. The Central Electricity Generating Board is made up of a chairman and from seven to nine other members as appointed by the Minister. The principal duty of the Board is to develop and operate the main generating and transmission system for making available bulk supplies of electricity in England and Wales—the responsibilities also include the programme for the construction and operation of nuclear power stations.

During the nine years of operation since Vesting Day, the statistics issued by the Central Electricity Authority as part of their annual report and accounts have clearly shown the changes and achievements that have taken place within the industry. Some of the more important aspects in connection with generating stations and plant are of particular interest, and taking the results for 1957/58 as provisional, they show that at the end of the year 1947/48 the installed generating capacity was 11,680-MW as compared with the 1956/57 figure of 22,572-MW—an increase of 93.2 per cent. At Vesting Day the number of power stations in operation was 288, a total that was reduced by 26 to 262 by the end of 1956/57, while the number of actual generating sets was reduced by 33, from 1,160 to 1,127. New power stations commissioned since April 1st, 1948, number 51, and again referring to actual generating sets, in the year 1947/48 there were 17 commissioned with an installed capacity of 534-MW, while in 1956/57 the total was 43 sets commissioned with an installed capacity of 1,828-MW.

Throughout the period the question of availability of fuel has become one of increasing importance, and a further interesting comparison is that of the coal burned in pulverised form as against the total coal consumed. The 1947/48 figure was 22.6 per cent., and the 1956/57 figure 59.5 per cent. The average overall thermal efficiency of all power stations at Vesting Date was 20.91 per cent., as against the 1956/57 figure of 24.96 per cent. The figure in 1948 for the highest individual station was 26.75 per cent., compared with 30.62 per cent. for 1956/57. An additional point that emerges from the available statistics is that with the installation of larger capacity generating sets the actual space occupied by the plant has been reduced from an average of 50 cu. ft./kW installed in 1947/48 to 28 cu. ft./kW installed in 1956/57. Important savings should also result in manpower required per kW, both in the building and operation of these larger units.

The trend towards the use of larger generating sets is emphasised when considering the plant programme for 1962, which was approved by the C.E.A. during the year under review. This includes units of 200-MW, 120-MW, 100-MW, and one of a new rating of 275-MW, while development work is also proceeding on a 550-MW cross-compound machine. Announcements have already been made regarding the power stations where units of these capacities will be installed. At Thorpe Marsh, near Doncaster, it is proposed to build a 1,100-MW thermal station where the plant will, it is expected, comprise two 550-MW cross-compound sets. Two units of 200-MW capacity are already on order from Metropolitan-Vickers Electrical Co. Ltd. for Willington "B" power station, near Derby, and as in the case of the 200-MW sets for West Thurrock, these will incorporate a new development—direct water-cooling for the stator windings of the alternators. A 30-MW machine employing this form of cooling has been commissioned at Bold "A" power station, St. Helens, and this was described in the January, 1957, issue of this journal.



Direct gas-cooled 100-MW alternator for Willington "A" power station, undergoing test at Stafford works of The English Electric Co. Ltd.

A further system of direct cooling for large turbo-alternators, using hydrogen as a coolant in direct contact with the hollow stator and rotor conductors and the core, has been developed by The English Electric Co. Ltd., and this method is being applied to one of the four 100-MW machines now being installed at Willington "A," while the company anticipate that the system will be suitable for outputs of at least 300-MW. It is, in fact, being incorporated in the 200-MW set they are building for High Marnham power station, which is

due to be commissioned this year, and which, incidentally, will be the first machine of that capacity to operate commercially in this country.

Referring specifically to 1957, new generating plant was installed with an additional output capacity of 1,788-MW, a figure that compares favourably with the record of 1,797-MW achieved in 1956, and is nearly 3½ times the amount commissioned during the first year of public ownership. New plant commissioned in power stations owned by the South of Scotland Electricity Board had an output capacity of 84-MW. The additional plant installed by the C.E.A. was in 28 power stations and comprised 34 turbo-alternator sets and one hydro-electric unit, with a total installed capacity of 1,903.5-MW, and 41 boilers having an aggregate evaporative capacity of 15,950,000 lb./hr. Four of these stations were new establishments in which plant was installed for the first time. Of the 41 new boilers, two each having an evaporative capacity of 550,000 lb./hr. were oil-fired, while in addition, at four existing coal-fired stations eight boilers with an aggregate evaporative capacity of 2,860,000 lb./hr. were converted to oil-firing.

The commissioning during the year of the first 60-MW set at Rogerstone power station exactly three years after work started on the virgin site, with the second and last set being brought into service three months later, was a record in speed of construction, while a further achievement was the commissioning in three different stations of five 100-MW units all operating at 1,500 lb./sq. in. steam pressure. These units can be regarded as the prototypes of the larger generating sets due to come into service at intervals during the next five-year period, and to which reference has already been made.

It may be of interest to note that the peak demand met by the Authority during the year was on December 16th, when 19,311-MW were supplied at full voltage and frequency. This was 1,643-MW above the peak load met at the beginning of the year, and over 124 per cent. above the peak demand of 8,607-MW met in England and Wales in the year prior to nationalisation.

Nuclear power progress

The provisional plan relating to the construction of nuclear power stations for the electricity authorities, published as a White Paper in 1955, envisaged twelve stations producing by the end of 1965 a total of from 1,500 to 2,000-MW. Due, however, to rapid technical advances it soon became apparent that the carrying out of a far more extensive programme was possible, and accordingly, in March, 1957, the Minister of Power, Lord Mills, announced that the original plan had been revised to the extent that an installed capacity of 5,000 to 6,000-MW would now be the aim for the end of 1965. This constituted a threefold increase over the original figure suggested, but it was stressed that as the output of individual stations could now be increased, only nineteen stations might be necessary to provide the new planned capacity.

Four of these stations are already under construction—Berkeley in Gloucestershire, Bradwell in Essex, and Hinkley Point in Somerset, for the Central Electricity Generating Board, and Hunterston in Ayrshire for the South of Scotland Electricity Board. It is also proposed that application should be made to the Minister of Power and Local Planning Authority for consent to develop the Generating Board's fourth station at Trawsfynydd, Merionethshire, in North Wales, while at the time the revised pro-

(Above). Calder Hall "B" power station and (right) Chapelcross "A" power station of the United Kingdom Atomic Energy Authority. The two reactors at Calder "B" and the four at Chapelcross will all be in operation before the end of 1959.

gramme was published it was announced by the Electricity Board of Northern Ireland that they hoped to have a 150-MW nuclear station commissioned by 1963 or 1964, and that they were investigating possible locations.

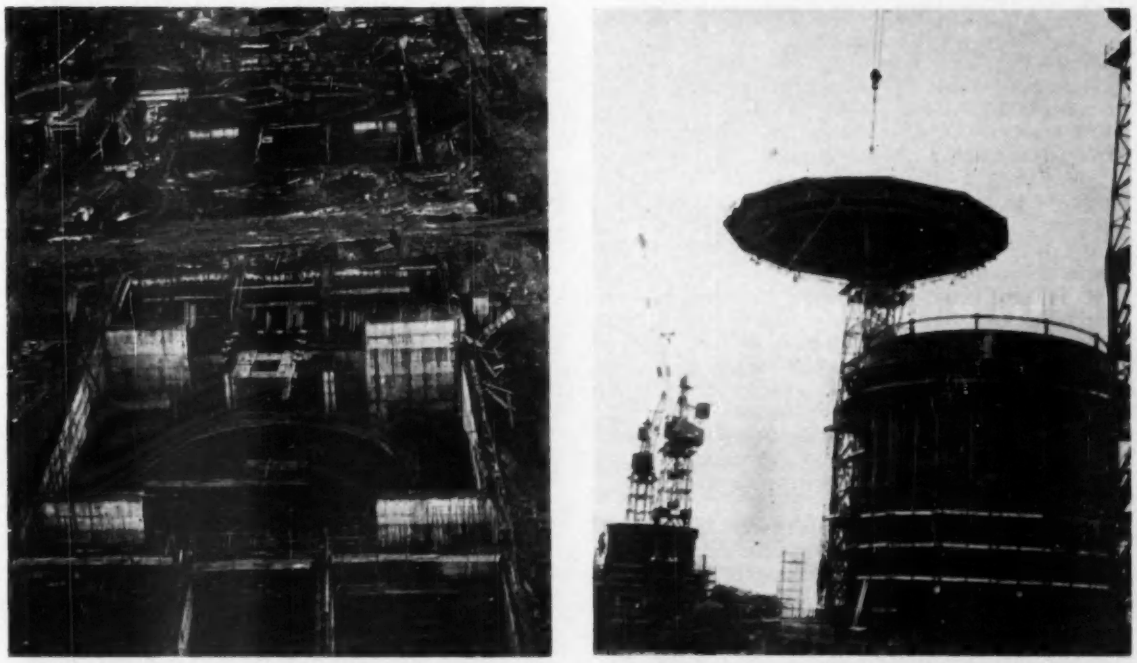
Tenders for the Bradwell, and Berkeley stations were received by October 1st, 1956, and construction started in January, 1957. Each station will comprise two natural uranium, carbon-dioxide gas-cooled, graphite-moderated reactors and will employ a dual-pressure steam cycle. The Bradwell station being built by the Nuclear Power Plant Co. Ltd. will have a guaranteed total net output capacity of 300-MW, provided by six turbo-alternators each of 52-MW rating, with high-pressure steam conditions of 755 lb./sq. in. and 704 deg. F. In addition approximately 30-MW will be generated in separate variable-speed turbo-alternators to supply the motor-driven blowers which circulate the carbon-dioxide coolant-gas. The Berkeley station, being built by the A.E.I.-John Thompson Nuclear Energy Co. Ltd., will have a guaranteed net output of 275-MW from four turbo-alternators each of 80-MW rating, with high-pressure steam conditions of 306 lb./sq. in. and 612 deg. F. The blowers in this case will be driven by motors on the main station supply, through hydraulic couplings. Work on these sites is proceeding rapidly, and it is hoped that at each station the first reactor with its associated plant will be brought into operation in 1960.

Work on the site at Hinkley Point, where the English Electric-Babcock & Wilcox-Taylor Woodrow Group are building a similar type of station, but of 500-MW output capacity, began during September, 1957. Here the six main turbo-alternator sets are of 93.5-MW rating, while three smaller units, each of 33-MW capacity, will supply power to the gas blowers. The six steam-raising units for each of the two reactors will generate more than 5.5 million lb. hr. of steam per hour, divided approximately as two-thirds high-pressure and one-third low-pressure.

At Hunterston, where preliminary work is already well advanced, the General Electric—Simon-Carves Atomic Energy Group are building a 360-MW station which will contain six turbo-alternators associated with two reactors and eight steam-raising units. Steam will be supplied at the following conditions :— high-pressure at 555 lb./sq. in. and 690 deg. F., and low-pressure at 135 lb./sq. in. and 660 deg. F.

Research and development work has been continued with marked success by the United Kingdom Atomic Energy Authority, and apart from investigations being carried out at Harwell and similar establishments, achievements during the year include the completion and putting into operation early in February of the second reactor at Calder Hall " A." In addition, the first reactor of the Calder Hall " B " station was structurally complete by the end of March, and was being fitted out with the many plant items and auxiliaries required. At Chapelcross rapid progress in constructional work has taken place. The extent of this progress can be judged by the fact that the two reactors at Calder Hall " B " and the four at Chapelcross are due to be placed in operation during the current year and 1959. The total electrical output from Chapelcross station will be similar to that of the combined Calder " A " and " B " stations—namely 150-MW. These stations are essentially dual-purpose enterprises for the production of plutonium as well as for the generation of electricity.

The Calder Hall and Chapelcross reactors, upon which



(Left). View showing progress made by the end of December, 1957, on the construction of Nos. 1 and 2 reactors at Bradwell Nuclear Power Station. (Right). Temporary roof on No. 2 reactor at Berkeley Nuclear Power Station (January, 1958) being raised to allow another 10-ton 3-in. steel plate to be lowered into thermal shield for welding into pressure vessel.

the design of the first electricity authority plants have been based, are of the gas-cooled, graphite-moderated type. It is expected that these will be followed by liquid-cooled thermal reactors, and then by reactors with a " positive gain factor " to allow a much higher utilisation of fuel. To investigate the engineering, chemical, irradiation and safety problems of the operation of these advanced reactors on an industrial scale, the U.K.A.E.A. have built at Dounreay in the North of Scotland an experimental fast breeder and materials testing establishment. A full account of this work was published in the June and July, 1957 issues of this journal, when it was stated that a fast-breeder, liquid-metal-cooled reactor, constructed on the site, would become " critical " early in 1958.

BRITISH THOMSON-HOUSTON CO. LTD.

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Of special significance during the year was the official opening of the BTH Larne Works ; and the despatch of the first turbine, twelve months after the main turbine factory had been completed.

A really outstanding BTH achievement in 1957 was the award of a very large contract from the Water and Electric Energy Board of the Ministry of Industry and Commerce of the Argentine. This contract, obtained in the face of strong competition and valued at well over £30 million, was awarded jointly to the BTH Export Co. and International Combustion (Export) Ltd. It covers the supply of plant for the new 600-MW Greater Buenos Aires Power Station, which will be built on reclaimed land, and which will be one of the world's largest thermal stations, doubling the present installed power generating capacity in Greater Buenos Aires. The plant to be supplied by BTH includes turbo-alternators, transformers, switchgear, motors and control gear. Another overseas order of particular note has been received from Spain and covers the supply of plant for two more hydro-electric power stations together with extension equipment for existing BTH installations.

Four of the six 30-MW turbo-alternators supplied by the British Thomson-Houston Co. Ltd. for the Goldington power station, which was formally opened on August 16th, 1957.

Turbo-alternators

The new turbine works at Larne was officially opened by His Royal Highness the Duke of Gloucester, on Thursday, October 24th, 1957, in the presence of Lord Wakehurst, Governor of N. Ireland, Lord Chandos, chairman BTH, Mr. E. H. Ball, managing director, and other officials of the company. The main turbine factory was completed in November 1956, and commenced manufacture immediately. The first machine to be despatched from Larne was a 30-MW single cylinder turbo-generator for the Chamoun thermal power station of L'Office de l'Electricité et du Transport en Commun at Zouk Mikhael, Beirut, in the Lebanon.

This turbine is a seventeen-stage machine running at 3,000 r.p.m. and operating under steam conditions of 600/625 lb./sq. in. with a total temperature of 850/875 deg. F., and a vacuum of 28.15 in. The turbine is direct-coupled to a 35,294-kVA, 11,000-volt, 50-c/s, three-phase, 0.85 p.f., air-cooled alternator.

For the Argentine Contract, mentioned above, BTH will supply five 120-MW turbo-alternators, each of the three-cylinder, reheat, double-flow, exhaust type, rated 120-MW, 3,000 r.p.m. The operating conditions for the turbines are 1,750 lb./sq. in., 1,040 deg. F. with reheat to 1,000 deg. F., and a condensing vacuum at 120-MW equivalent to 1.4 Hg abs. The final feed temperature with six stages of feed heating will be 435 deg. F. Each generator will be rated at 150-MVA, 13.8-kV, three-phase, 50 c/s and will be hydrogen-cooled with direct-cooled rotor conductors.

An order was received from the C.E.A. for two 120-MW sets for the Padiham " B " Generating Station in the North West, Merseyside and North Wales Division. These machines are to be of the three-cylinder, triple-flow type with initial steam conditions of 1,500 lb./sq. in. at a temperature of 1,000 deg. F., and with reheat to 1,000

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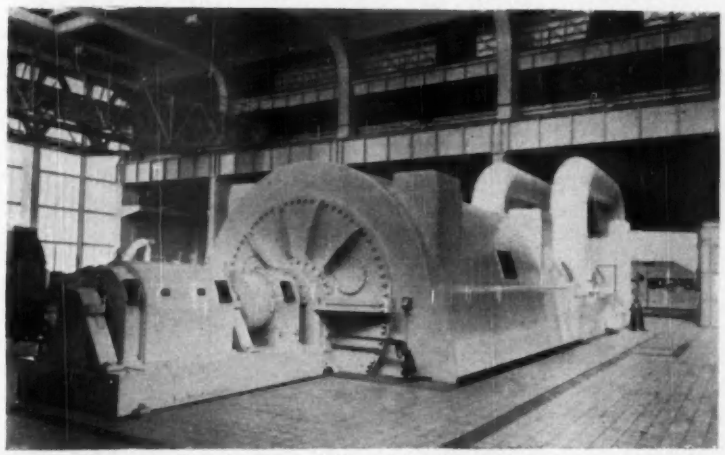
A fourth BTH 11,175-kW low-pressure turbine has been ordered for the Wairakei Geothermal scheme in New Zealand. This is the eighth and final machine to complete the first part of the project. The first four are also of BTH manufacture, but of different rating. A further contract has been received from A.E.I. (Australia) for a 3,125-kW turbine for the Southern Portland Cement Co., and a 2,500-kW back-pressure geared turbo-alternator set is being supplied to the order of Messrs. Kennedy & Donkin for the Electricity Board of Northern Ireland.

Several interesting machines have been completed during the year. For the Central Electricity Generating Board two further 60-MW sets for the Meaford " B " Power Station have been commissioned to complete the present station. Each machine is designed for the high steam conditions of 1,500 lb./sq. in. and 1,050 deg. F. Two more 30-MW turbo-alternators have also been completed for the Goldington Power Station of the Central Electricity Generating Board.



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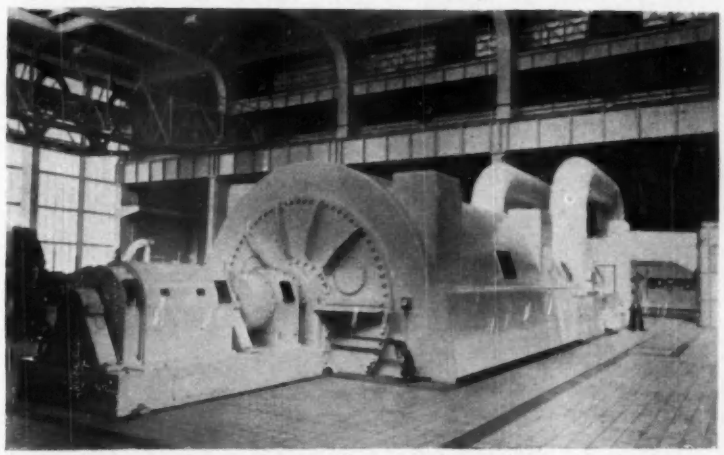

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were obtained on both slot- and end-winding portions of the windings. These measurements, together with the usual embedded temperature detector readings, are claimed to have appreciably extended the knowledge of the distribution of temperature in a stator winding at various values of hydrogen pressure.

Nuclear power development

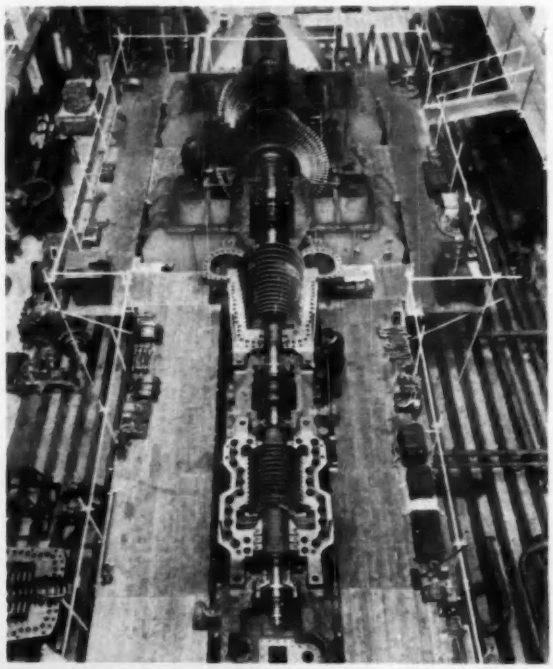
An order was received by the company in the early part of the year for gas-circulators for the Berkeley Nuclear Power Station, and a prototype machine has already been on test. Production work on the main order is now in hand. Development work has been proceeding on bellows for use in the main carbon-dioxide ducting, and tests to destruction have been made under conditions which simulated as near as possible the working pressure, temperature, and deflection. Manufacture of the main bellows has now started. In the field of nuclear energy, proposals have been submitted for 13-MW turbines, for which some preliminary development has been carried out. Whilst the turbine itself will not greatly differ from the BTH standard range, problems arising from excess moisture content of the steam are receiving special attention.

The main contribution of the BTH Electronics group to the current nuclear energy programme is the development and manufacture of the neutron absorber rod controls for the Berkeley power station. This work is essentially in two principal co-ordinated parts ; first the provision of the actuator mechanisms, one for each absorber rod, of which there are several hundred in the station ; and second, the control system for these actuators. The actuators are mounted on top of the reactor pressure vessel and are exposed to somewhat adverse conditions, both as regards temperature and radiation from the reactor core. Position control of each absorber rod is given via a suspension rope, gear transmission, and a special synchronous motor. The latter is specially designed for the duty and also acts as a brake during certain emergency conditions. A new type of selsyn for remote indication of rod position has also been developed, a feature of both the selsyn and the motor being that neither brushes nor sliprings are used.

The external control system is concerned primarily with the provision of a variable-frequency power supply to the large number of motors in the actuators ; this supply is controllable down to zero frequency when the rods are to be held at fixed positions.

THE ENGLISH ELECTRIC CO. LTD.

Overseas orders received during the year by The English Electric Co. Ltd. include steam turbo-alternators for places as far apart as Baghdad, Barbados, Hong Kong and New Brunswick. At home, of special significance is the order from the Central Electricity Generating Board for the turbo-alternator sets for the Hinkley Point, Somerset, nuclear power station. This station will have



(Above). One of the 100-MW turbo-alternator sets for Willington "A" power station, shown under construction at works of The English Electric Co. Ltd.

(Left). Three of the four 60-MW turbo-alternators supplied by The English Electric Co. Ltd. and installed at Wakefield "B" power station.

an output capacity of 500-MW, and is being built by the English Electric-Babcock & Wilcox-Taylor Woodrow Group.

An order from the Central Electricity Generating Board for a further two 200-MW turbo-alternator sets now completes the quota of five such sets being built by the company for what will be the first 1,000-MW capacity power station in Europe, now under construction at High Marnham (East Midlands Division). These machines, which are to be coupled in line, will run at 3,000 r.p.m. with operating conditions of 2,350 lb./sq. in., 1,050 deg. F. with reheat to 1,000 deg. F., and exhausting to 28.7 in. Hg. vacuum. The alternators are to be of the direct hydrogen-cooled type, generating at 16,500-V with a rated gas pressure of 30 lb./sq. in. The Central Electricity Generating Board have now also obtained consent for the construction of their Uskmouth " B " power station (South Wales Division), in which The English Electric Co. Ltd. will install three 120-MW turbo-alternator sets. These will be three-cylinder machines, coupled in line, running at 3,000 r.p.m., with operating conditions of 1,500 lb./sq. in., 1,000 deg. F., with reheat to 1,000 deg. F., and exhausting to 28.9 in. Hg. vacuum. The alternators are to be hydrogen-cooled, employing direct cooling of the rotor conductors only, and generating at 13,800-V with a rated gas pressure of 30 lb./sq. in.

The turbines for the Hinkley Point nuclear power station will comprise six 93.5-MW maximum load units for the station's main requirements and three 33-MW m.c.r. variable-frequency turbo-alternators, one of which will be a standby, for the supply of power to the gas blowers.

Export orders received during the year include a 50-MW turbo-alternator set for the New Brunswick Electric Power Commission, Seaboard station, Southern New Brunswick—a 3,600 r.p.m. machine operating at 1,450 lb./sq. in. and 1,000 deg. F. An order for a second 30-MW set, running at 3,000 r.p.m., and operating at 600 lb./sq. in. and 850 deg. F., was received from the Hong Kong Electric Co. Ltd. for their North Point " B " power station, while other orders covered a 2,500-kW set (No. 2) for Barbados Electric Supply Corporation Ltd. and a 2,000-kW set (No. 5) for the Government Oil Refinery, Baghdad.

During the year, the first 100-MW turbo-alternator set for Willington " A " (East Midlands Division), the fifth 60-MW set for Marchwood (Southern Division), the fourth 60-MW set for Wakefield " B " (Yorkshire Division), and two further 30-MW sets for Mexborough (Yorkshire Division) were put into commission for the Central Electricity Generating Board. Plant commissioned overseas during the period included a 45-MW, 3,600 r.p.m., 900 lb./sq. in., 900 deg. F. set at the Water Street power station of the Nova Scotia Light and Power Co. Ltd., Halifax ; a 30-MW set for Umgeni power station and another 30-MW set for Pretoria " B " power station (No. 4) ; a 14,250-kW set at St. George's Bay power station, Athens, and two further 10-MW sets (Nos. 2 and 3) at Penang power station, Malaya.

C. A. PARSONS & CO. LTD.

The orders received during the year for turbo-alternators include many for large machines ranging in size up to 300-MW. Two machines of 300-MW output have been ordered by the Hydro-Electric Power Commission of Ontario for a new power station to be built at Long Branch, near Toronto, and they are the largest machines ever ordered by a Canadian utility undertaking, and the largest machines to be built in this country. These sets will be of the cross-compound type, and will operate with steam conditions of 2,350 lb./sq. in. pressure, 1,000 deg. F., and reheating to 1,000 deg. F. In addition, the Hydro-Electric Power Commission have ordered a fourth 200-MW set for the Richard L. Hearn Generating Station, Toronto. These four machines are also of the cross-compound type, but will take steam at 1,800 lb./sq. in. pressure, 1,000 deg. F. temperature and with reheat to 1,000 deg. F.

A second 200-MW turbo-alternator was ordered by the Central Electricity Authority for West Thurrock power station. These sets are single-line machines running at 3,000 r.p.m. and will operate with steam conditions of 2,350 lb./sq. in. and 1,050 deg. F., and reheating to 1,000 deg. F. In addition, orders have been received for machines of 120-MW output ; viz., a fourth machine for Skelton Grange " A " power station ; two more for the Drakelow " B " station, and a third machine for Kincardine power station. There are now a total of thirteen machines of this size on order and under construction. These sets are of the three-cylinder type designed to operate with steam at 1,500 lb./sq. in. pressure, 1,000 deg. F. temperature and with reheating to 1,000 deg. F. Three further machines of 100-MW output have been ordered for the Aberthaw power station, making six machines of this output for the station. In addition, a number of machines for outputs of 30, 25 and 20-MW output have been ordered for export to South Africa, Canada and Mexico.

During the year a large number of turbo-alternators have been completed on site or put into commercial operation. In this country a 190-MW set was completed at the Ferrybridge " B " power station, also eight 60-MW sets, these latter being installed at Tilbury " A " (three), Belfast (two), Rogerstone (two) and a second machine at Dalmarnock. Machines of 30-MW output were completed at Connah's Quay (sixth machine), East Yelland (sixth machine) and Hackney " B " (third machine). A number of machines of outputs from 3.85-MW up to 20-MW have also been completed for industrial installations. Amongst these is a 15-MW two-cylinder turbo-alternator set installed in the Mersey Mill of the Bowaters Paper Corporation. This machine operates with steam at 900 lb./sq. in. pressure, 900 deg. F. temperature and is designed to pass out steam at two different pressure points for process purposes. Two 6-MW machines have been completed for the Thames Board Mills Ltd. and installed in their Mersey Works. These machines operate with steam at 585 lb./sq. in. pressure, 800 deg. F. temperature, one being designed for passing out steam at 40 lb./sq. in., while the other is a " back-pressure " set, the exhaust pressure being 40 lb./sq. in.

A number of machines have also been installed overseas. In South Africa, the Taaibos power station containing eight 60-MW sets was completed during the year. In Australia, 50-MW sets were installed at Lake Macquarie and Yallourn power stations, also 30-MW sets at Port Augusta, Osborne " B," Bunbury and Tennyson. A third 30-MW set was completed at Bulawayo, Southern

Rhodesia, a 20-MW set at Trinidad, B.W.I., and a second 12.5-MW set at Baghdad.

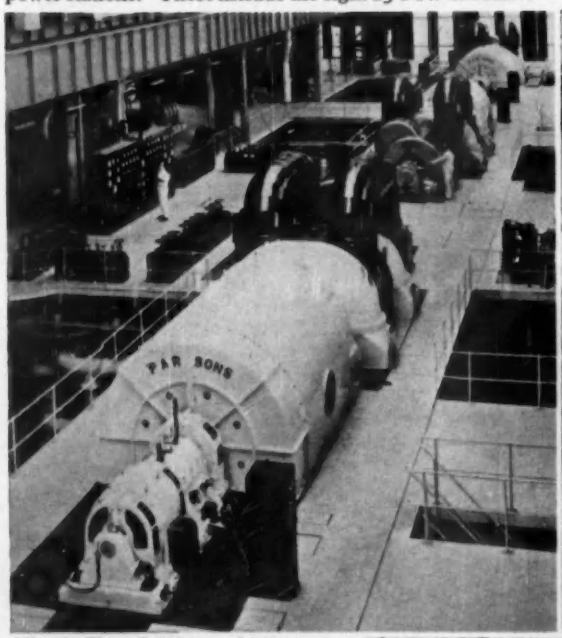
At the beginning of the year a large turbo-blower was put into commission at the steel works of the Appleby-Frodingham Steel Co., at Scunthorpe. This turbo-blower is believed to be the largest in the world, its duty being to deliver 160,000 cu. ft. of free air per minute at a pressure of 35 lb./sq. in. It is designed for split-wind blowing, i.e., to supply additional air to four separate furnace mains individually supplied by four existing turbo-blowers.

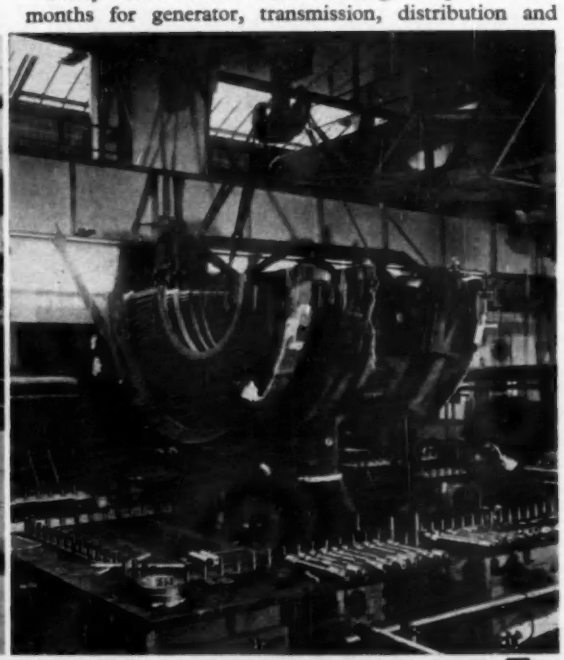
Nuclear Power Plant

The Parsons Company have now installed or have on order, 740-MW of turbo-generating plant for nuclear power stations. These include the eight 23-MW machines for Calder Hall "A" and "B," eight similar sets for Chapelcross, and the six 52-MW main turbo-alternators and three 20.25-MW auxiliary sets ordered for the Bradwell station. The Bradwell contract also includes the supply of all the condensing plant, dump condensers, main gas-circulators, gas-ducting and valves, the charge tube assemblies and control rod assemblies, fission product detection compressors and the instrumentation, including the start-up equipment. During the year two of the four 23-MW sets for Calder Hall "B" and the first machine at Chapelcross power station have been completed.

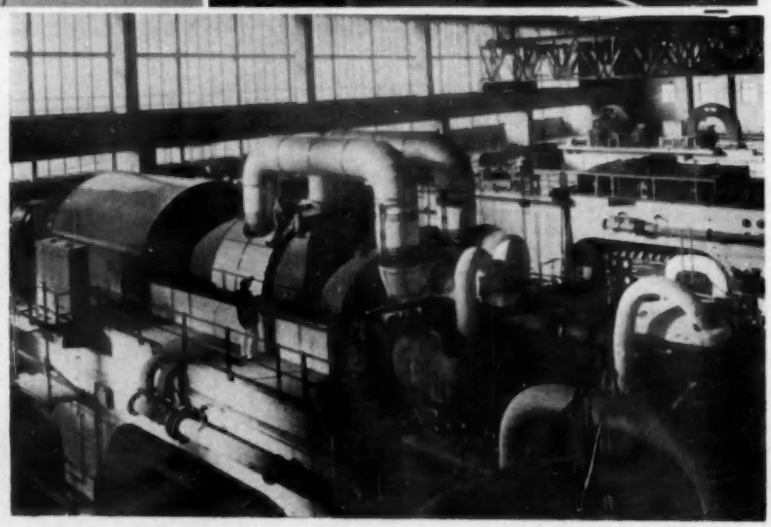
Transformers

Many orders were received during the past twelve months for generator, transmission, distribution and





(Above). *Three C. A. Parsons 30-MW turbo-alternators, installed at the Ringsend power station, Dublin.*



(Above, right). *The low-pressure section of a 200-MW turbo-alternator, under construction at the Heaton works of C. A. Parsons & Co. Ltd. Two units of this capacity are now on order for West Thurrock power station.*

(Right). *The first of three Parsons 100-MW turbo-alternators installed at Ferrybridge power station is shown here nearing completion.*

mining type transformers. In connection with the Bradwell nuclear power station contract, C. A. Parsons & Co. Ltd. are supplying all the electrical transformers. Each turbo-generator will be directly connected to a 64-MVA 11.8/141.6-kV 3-phase transformer fitted with high-speed resistor-type tap-changing on-load equipment on the HV side. Each transformer will be provided with two 100 per cent. oil-water coolers, the pipework of which is arranged so that either oil pump may be used with either cooler. Associated with each generator is a 3-MVA 11.8/3.45-kV 3-phase ON unit transformer, the L.V. of which is connected to the 3.3-kV turbine house switchboard.

The low-voltage supplied for the reactors and all the station auxiliary services will be obtained from 3,300/433-volts 3-phase delta-star connected transformers having ratings between 1,250-kVA and 200-kVA. Also under construction are a number of large generator transformers which will be connected to the 275-kV supergrid system in this country. These include a 210-MVA 3-phase transformer 15/275-kV for West Thurrock power station. Associated with this transformer are two station transformers rated at 22.5-MVA, naturally cooled, for operation at 275/7.1-kV. Another large transformer is a 106-MVA unit 13.8/275-kV for the Ferrybridge "B" power station. Also under construction are two 75-MVA generator transformers for operation at 14.4/132-kV for the Boundary Dam Generating Station, Saskatchewan.

Many large transformers have been completed during the year. The first of three 120-MVA units with a voltage range of 275/132-kV has been completed for the C.E.A. at the Harker sub-station near Carlisle. It is a three-phase auto-transformer unit with on-load tap changing gear. Another transformer for the C.E.A. is the first of two 45-MVA 132/33-kV designed to be fully transportable spares.

Central Electricity Generating Board —some further appointments

The Central Electricity Generating Board announce the following appointments :

Mr. D. P. Sayers, B.Sc., M.I.Mech.E., M.I.E.E., M.Amer.I.E.E., Chief Contracts Officer of the Board, to be Chief Commercial and Operations Engineer of the Board.

Mr. Sayers had been assistant engineer at Sheffield and later deputy engineer and manager of the City of Birmingham Electric Supply Department prior to the reorganisation of the industry in 1948. In that year he became chief engineer of the Midlands Electricity Board and then was appointed deputy chief engineer (transmission) of the British Electricity Authority. In 1954 he returned to the Midlands Board as deputy chairman and three years later took up his present duties.

Mr. E. S. Booth, M.I.Mech.E., M.I.E.E., Deputy Chief Engineer (Design and Construction) of the Board, to be Chief Design and Construction Engineer of the Board.

Mr. Booth, after training with Metropolitan-Vickers Electrical Co. Ltd., joined the staff of the Yorkshire Electric Power Company as construction engineer. In 1947, after serving a year as deputy, he became city electrical engineer and manager at Salford. On the reorganisation of the electricity supply industry in 1948, he was appointed generation construction engineer of the North Western Division of the British Electricity Authority, and two years later joined the headquarters staff as co-ordination engineer (construction), subsequently becoming generation station construction engineer. In 1957 he took up his present duties.

Mr. W. H. Dunkley, B.Sc., M.I.Mech.E., M.I.E.E., Chief Generation Engineer (Construction) of the Yorkshire Division, to be Controller of the South Eastern Division.

Mr. Dunkley, after apprenticeship with the English Electric Co. Ltd., joined the Dundee Electricity Department in 1926 and, two years later, went to Shanghai as assistant charge engineer of the Riverside power station, afterwards serving in the chief engineer's department. He returned to England in 1934 to join the Central Electricity Board as operation superintendent for S.W. England and S. Wales. Three years later, he joined the Hull Corporation Electricity Department where he became deputy general manager. In 1948, he was appointed chief generation engineer (construction) of the Yorkshire Division.

Mr. F. W. Skelcher, M.I.Mech.E., M.I.E.E., Deputy Chief Engineer (Generation and System Operation) of the Board, to be Controller of the Midlands Division.

Mr. Skelcher took up his first appointment with the City of Birmingham Electric Supply Department in 1926. He served in the department for 22 years, finally becoming deputy generating stations engineer. In 1948, he was appointed generation engineer (operations) of the Southern group of power stations of the Midlands Division, and two years later became chief generation engineer (operations) of the same Division. In July of last year he took up his present duties.

Mr. J. L. Ashworth, A.M.I.Mech.E., A.M.I.E.E., Deputy Divisional Controller of the North West, Merseyside and North Wales Division, to be Deputy Regional Director of the North West Merseyside and North Wales Region.

Mr. Ashworth, after holding various positions with Metropolitan-Vickers Electrical Co. Ltd., joined the Manchester Corporation at their Stuart Street power station and later served with the Hull Corporation Electricity Department. He then went to the Halifax Corporation as maintenance engineer, and later joined the Mersey Power Company Ltd., as engineer-in-charge of their plant construction—subsequently becoming generation engineer of the company. In 1948, he was appointed chief generation engineer (operations) of the North West Division, and when that Division amalgamated with the Merseyside and North Wales Division in 1954, was appointed chief generation engineer (operations) of the new Division. Last year he became deputy divisional controller.

Mr. A. R. Clague, M.Eng., A.M.I.Mech.E., A.M.I.E.E., Chief Generation Engineer (Operations) of the South Eastern Division, to be Controller of the South Western Division.

Mr. Clague served his apprenticeship with the Metropolitan-Vickers Electrical Co. Ltd., where he subsequently worked as a mechanical draughtsman and then as a mechanical engineer. After nine years with the Belfast Corporation Electricity Department as assistant technical engineer, and later as assistant power station superintendent, he went in 1944 to the West Midlands Joint Electricity Authority, first as assistant generation engineer and then as generation engineer. In 1948 he was appointed generation engineer (operations) in the Midlands Division and took up his present duties five years later.

Mr. B. C. Pyle, M.I.E.E., Chief Generation Engineer (Construction) of the Southern Division, to be Chief Assistant Project Engineer, Northern Project Office.

Mr. Pyle received his technical eduation at Portsmouth Municipal College and was a student engineer with the Portsmouth Electricity Service. He then served with the Sheffield Corporation Electricity Department as junior technical assistant, returning to Portsmouth as technical assistant (electrical). With the reorganisation of the industry in 1948, Mr. Pyle became personal assistant to the Controller of the Southern Division, and a year afterwards was appointed senior assistant engineer (construction) in that Division. He took up his present duties in 1953.

Mr. C. G. Richards, M.Sc.(Tech.), A.M.I.Mech.E., A.M.I.E.E., Chief Generation Engineer (Operations) of the Yorkshire Division, to be Controller of that Division.

Mr. Richards, after a college apprenticeship with Metropolitan-Vickers Electrical Co. Ltd., joined the outside erection staff of the company in 1928. He was employed by the Singapore Municipality from 1931 to 1945 (including internment there during the Japanese occupation), first as power station engineer and then as distribution engineer. In 1946 he was appointed generation engineer in the

Sheffield Corporation Electricity Department and on the re-organisation of the industry became chief generation engineer (operations) in the Yorkshire Division of the British Electricity Authority, holding this position to the present date.

Mr. W. Wilde, B.Sc.(Eng.), A.M.I.Mech.E., A.M.I.E.E., M.Inst.F., Chief Generation Engineer (Operations) of the London Division of the Board, to be Controller of the South Wales Division.

Mr. Wilde first joined the Sheffield Corporation Electricity Department where he occupied several engineering positions at Neepsend and Blackburn Meadows power stations. These were followed by a period in the stations of the Newcastle upon Tyne Electricity Supply Co., and then he joined the Lancaster Corporation as a charge engineer. In 1926 he took up the appointment as combustion engineer with the London Electricity Supply Corporation at Deptford East power station—and subsequently became station superintendent there with the London Power Co. In 1948 he was appointed generation engineer (operations) of Group II of the London Division's power stations, and three years later, became chief generation engineer (operations) London Division, a position he has held until the present time.

CYCLONE-FIRED BOILER INSTALLATION

In the December, 1957, issue of this journal we included an illustrated description of the first industrial cyclone-fired boiler to be installed in this country. The boiler, supplied by Babcock & Wilcox Ltd., is in service at the Kynoch works of the Metals Division of I.C.I. Ltd. It has a capacity of 200,000 lb./hr. and operates at a pressure of 925 lb./sq. in. —the final steam temperature being 915 deg. F. All the thermal insulation on the unit was provided and fixed in position by The Darlington Insulation Co. Ltd. The insulation material applied was of a preformed nature and consisted of "Dextramite" high-temperature insulation, and 85 per cent. magnesia insulation. The materials were carefully applied to various thicknesses to suit the temperature and other conditions prevailing at any particular point or section. The insulation was reinforced with 1 in. galvanised-wire netting and then supercoated with ½ in. hard-setting composition, trowelled to an even finish, and then painted. Expansion joints were fitted in the insulation where required. External insulation was weatherproofed with "Flintkote" type 99 emulsion. The Darlington Insulation Company has been responsible for providing and fixing the insulating material for boiler plant and auxiliaries, steam and feed piping, ducting, turbine plant, etc., at many of the large and recently completed power stations and industrial power plants, including, among others, Uskmouth, Keadby, Drakelow "A," Castle Donington and Ince. In addition, the company claims to be the first insulation contractors to work on a British nuclear power station viz. :—Calder Hall, where many new heat-insulation problems had to be dealt with.

At Ince power station (which was formally opened by Lord Citrine on October 9th, 1957) the first station to have boilers of semi-outdoor construction, the boiler drums are insulated first with ½-in. thick high-temperature heat-resisting plastic, followed by 1½-in. thick high-temperature heat-resisting slabs, secured with mesh galvanized-wire netting. On this, there is another ½-in. layer of high-temperature plastic with a further layer of 1½-in. thick h.t. slabs embedded. Finally, there is a ½-in. thick h.t. plastic layer trowelled smooth and even, to form a continuous unbroken surface. Other insulation work comprises Dextramite filled asbestos mattresses of various thicknesses according to temperature requirements. Side-wall tubes, riser tubes, etc., are insulated with 2-in. thick, 85 per cent. magnesia sections, securely wired-on, reinforced with galvanised-wire netting and supercoated with ½-in. thick hard-setting composition.

At Keadby power station, two of the six 550,000 lb./hr. twin-furnace radiant boilers are fitted with plastic casings instead of the conventional type of steel casings. The casings are protected with ¾-in. thick "Bulldog" cement, followed with a ⅛-in. thickness of "Flintkote" emulsion. Certain portions are covered with "Kimoloboard" ¾-in. thick and held in position by channel bands. This form of insulation is designed to reduce radiation losses to an absolute minimum. This, and all the remaining insulation on the Keadby boilers was supplied and fixed by The Darlington Insulation Co. Ltd.

WINDSCALE REACTOR ACCIDENT

Following the publication of the White Paper (Cmd. 302) on the accident at Windscale (to which we made reference in the December, 1957, issue of this journal), the Institution of Professional Civil Servants, who represent scientific, professional and technical staff in the Authority, alleged that certain of their members at Windscale felt aggrieved at what had been said in the White Paper about the part played by the operating staff in the accident. There has been correspondence and discussion with the I.P.C.S. The Chairman of the Authority, in his memorandum covering the report of the Committee of Enquiry into the Windscale accident stated that, although in the view of the committee the cause of the accident lay partly in faults of judgment by the operating staff, these faults were attributable to weakness of organisation. The responsibility was, therefore, primarily collective and the Authority did not propose to take any disciplinary action against any individual. The Authority have, nevertheless, consistently made it clear to the Institution that they are concerned to see that any member of their staff who feels that his position has been adversely affected by anything said in the report should be given an opportunity of putting his case. The Authority therefore suggested in early December to the I.P.C.S., that any member of the Authority's staff who felt that he had been unjustly criticised directly or by inference in the report, should be given the opportunity of making representations to a panel consisting of three Authority members (Sir John Cockcroft, Mr. C. F. Kearton, Sir Donald Perrott). This offer, however, was not taken up. Sir Donald Perrott has now offered to go personally to Windscale to hear any representations the staff there may wish to make concerning factual statements in the Report bearing on the responsibilities of the staff concerned.

NEW BOOK

"Factory Organisation and Management." *(Seventh edition.) By T. H. Burham, B.Sc. Hons. (Lond.), B.Com. (Lond.), F.I.I.A., M.I.Mar.E., A.M.I.Mech.E., A.M.I.E.E., A.M.I.Prod.E., and D. H. Bramley, M.I.Mech.E., M.I.Prod.E. 394 pages. Text area 3½ in. × 6 in. 95 graphs, sample forms, etc. Published by Sir Isaac Pitman & Sons Ltd. Price 25s.*

This work, one of the Pitman Engineering Degree Series, is Book II of the Engineering Economics textbooks on industrial administration, Book I being entitled "Elements of Industrial Organisation." The present edition, the seventh published since 1929, has been brought up-to-date where necessary, and now provides for all who require a systematic preparation for industrial responsibility, and particularly mechanical engineering and production engineering students, a comprehensive study of the subject, covering the requirements of the new syllabuses on Factory Management and Organisation as developed in the Ministry of Education White Paper on Education and Training for Management. It deals fully with the functions of management, personnel, design and sales ; sections are included on production facilities, planning production, and the control of production ; while the final chapters cover purchasing, wages and incentives, control of expenditure and estimating.

Mr. J. W. Davies has retired from the board of directors of Ferranti Ltd., after nearly 60 years' service with the company. Mr. Davies, who is now 78, commenced work with the Ferranti Company on November 1st, 1898, as a tool maker, becoming tool room foreman in 1905. He became works manager of the meter department in 1911 ; was appointed general works manager in 1925 and became a director in 1942. During his earlier days with Ferranti Ltd. he was closely associated with Dr. S. Z. de Ferranti, the company's founder.

* * *

It is with regret that we record the death, as a result of a car accident, near Derby, on January 9th, of **Mr. J. Lionel Daniels,** M.I.Mech.E., chairman and managing director of T. H. & J. Daniels Ltd., Stroud, Gloucestershire, of Prat Daniel (Stanmore) Ltd., and of British Boiler Accessories Ltd.

Progress in Stainless and Heat-Resisting Steels

By J. LOMAS

THE industrial growth of countries not perhaps previously regarded as leaders in the metallurgical field necessitates for the first time in this annual article some attention to their progress. In the U.S.S.R., for example, a great amount of research and experiment is going on in connection with various metals, and some of the results of this work are inevitably reflected in the contribution they are making to the technology of the stainless and heat-resisting steels.

One such investigation concerns the magnetic susceptibility of austenitic alloys containing from 5 to 28 per cent. of chromium and quenched from three different temperatures in the temperature zone 20 to 800 deg. C. It has been found that this susceptibility decreases in every instance with increasing temperature, the values obtained increasing with decreasing chromium content. An increase in the annealing period causes periodic changes in magnetic susceptibility, and these are attributed to the formation and decomposition of carbide phases.

Research in the U.S.S.R. has also been carried out on the effect of the elements, niobium and tantalum, on the properties of stainless steel, whereby it would appear to have been established that resistance to intercrystalline corrosion in stainless steel alloyed with niobium is greater than that of a similar steel alloyed with titanium, while at the same time the weldability of the steel is improved when niobium is an alloying element.

In the United States, tests have been carried out on the tensile properties of stainless steels at room temperature, and in the temperature range 370 to 600 deg. C., and the results, which are too elaborately detailed for even brief condensation, will be found in *Trans. Amer. Soc. Metals*, 1955, 48, *Preprint No.* 41. The tests cover four different types of stainless steels, two containing 12 per cent. chromium and two containing 16 per cent. chromium, with varying amounts of nickel and nitrogen. Other tests on the same steels covered creep and creep-rupture properties in the temperature range 480 to 650 deg. C.

In the higher temperature range, tube sections of stainless austenitic steel have been removed from an experimental superheater after it had operated for 6,950-hr. at 1,250 deg. F., and a pressure of 2,000 lb./sq. in. No evidence of serious impairment of essential properties could be perceived in any of them, although certain of the weld metals, especially 18/12 molybdenum and 17/14 copper molybdenum, had suffered a great deal of impact embrittlement.

The search for stainless steels that do not require nickel, a commodity still in comparatively short supply, continues, and a new nickel-free stainless steel has been introduced in America. Compositions have been found in which high nitrogen contents can be held, to maintain the stability of austenite up to 2,300 deg. F.

Japan is also contributing to research and development to the extent that metallurgists there have effectively demonstrated that the forgeability and oxidation resistance of nickel-chromium-cobalt heat-resisting steels (20-15-15 per cent.) are improved by additions of niobium, while nitrogen improves the tensile strength at high temperatures. Ageing hardness and creep limit, they state, are better if the solution treatment of 1,200 deg. C. is not given. A further development concerns a new alloy, made by vacuum fusion, for use in plant designed for exceptionally high temperatures, as, for example, super-duty turbine blades.

A novel development, reported from Czecho-Slovakia, is a thermo-electric method of sorting stainless steels. A heated and an unheated contact, separated by a fixed distance and connected to a galvanometer, are placed on the steel and the electromotive force is measured at standard differences of temperature. The method is claimed to provide several advantages as compared to spectroscopic sorting, inasmuch as the test can be made on the spot; no standard specimens are required; and there is no call for costly equipment or dark-room facilities. The method can be employed by calibrating the apparatus for different steels or by the use of standards.

The addition of 1 per cent. aluminium to a steel containing 17 per cent. chromium and 7 per cent. nickel has been advocated in some quarters, and it appears to be true that the steel so produced is suitable for parts subject to operating conditions up to 800 deg. F. The steel is said to have high strength-weight properties, and can be hardened partly by martensitic transformation at — 100 deg. F. and to a further extent by ageing at 950 deg. F. The steel is susceptible to heat-treatment.

India is another country in which interesting work is taking place. There, a 15 per cent. chromium, 0.7 per cent. carbon steel has been found to work-harden to what is said to be an unusual extent, almost equivalent to that of 11-15 per cent. austenitic manganese steel. Finely divided precipitates resembling carbides are seen to appear, but there is not a great deal of information available, and meanwhile additional work on the subject is being undertaken.

A further development concerns the use of stainless steel for the manufacture of a number of 600-gal. steam-jacketed kettles, the inside bottom shells of which are of pure nickel. The steel used is one containing 19 per cent. chromium, 10 per cent. nickel and 0.08 per cent. carbon. The kettles are of all-welded construction, employing double vee butt welds. The outer and inner shells were made in segments, the shells being stress-relieved after welding, with each shell hammered and annealed before assembly. The steam side of the inner nickel shell is mill-finished for more effective heat-transfer.

Not many years ago, stainless steel tubing was mainly employed in chemical works, but at the present time a large amount is used in power plant equipment, by reason of its adaptability to ever-increasing pressure

and temperature requirements. In one new plant generating steam at 4,500 lb./sq. in. and 1,150 deg. F., stainless steel tubing is used in the final section of the boiler superheater, for the main steam piping leading from the boiler to the high-pressure turbine, and for the rotor in the front end of this turbine.

Two new low-nickel chromium-manganese stainless steels were produced commercially for the first time in 1955, though such steels have been manufactured and used to a limited extent since 1930, mainly in Russia, Germany and other countries without ready access to nickel. These are now regarded not as substitutes for the high nickel steels of the stainless type, but as stainless steels in their own right. Their main advantage is that they give double the output of stainless steel with the same amount of nickel, this saving being achieved with no loss of quality. The new steels have somewhat higher tensile strengths and yield points ; their rupture strengths compare favourably ; and for high-temperature work they are said to show properties better than those of equivalent types in austenitic nickel-chromium stainless steels. Corrosion-resistance under difficult conditions has not yet been fully established.

The passing of industrial smoke and odours into the atmosphere is a problem that is at last receiving attention. Some firms have successfully experimented with flame deflectors designed to decrease smoke production by burning the smoke entirely. These have to withstand extremely high temperatures and severe thermal shock, and the alloy which has been found to give the most satisfactory results is a nickel-chromium-iron.

New techniques developed in the welding of austenitic stainless steels include a first-pass welding technique avoiding the employment of a backing-ring, and resulting in a smooth surface on the inside of the pipe, free from cracks, so preventing the formation of stress-raisers ; a closer control of chemical composition of the deposited weld-metal, with respect to its ferrite content ; and, finally, a solution heat-treatment of welded joints to ensure maximum ductility in the weld and the heat-affected zone. These techniques all relate to the use of austenitic steel piping in steam power stations. In this connection, weld-failures have been studied closely, and it has been shown that most of these are caused by the use of joining-methods since superseded by improved techniques.

Economic considerations involved in the design of boilers are leading to the combined employment of austenitic stainless steels and low-alloy ferritic steels in superheaters, reheaters and main steam lines, where high pressures, and temperatures above 540 deg. C., are involved. Some important tests have been carried out to determine the measures that should be adopted to eliminate the failure of welds of dissimilar metals. As a result, austenitic weld metals have been developed, one of the most effective being an alloy of 50 per cent. nickel, 10 per cent. chromium, with additions of niobium and tantalum. Joints made with electrodes of this metal have satisfactorily withstood cyclic conditions of temperature and stress such as would be involved in steam-boiler service under the above conditions.

A new stainless steel from the United States has the following somewhat intricate composition : carbon 0.04 per cent. max. ; nickel 4.75 to 6.00 per cent. ; chromium, 25 to 27 per cent. ; molybdenum 1.75 to 2.25 per cent. ; silicon 1 per cent. max. ; manganese 1 per cent. max. ; the balance being iron. It is claimed that the steel, when aged to a hardness below 325 Brinell by heating within the temperature range 370/480 deg. C., results in a good ductility at Brinell 300, a tensile strength of approximately 62.5 tons/sq. in. and a yield strength of approximately 44.5 tons/sq. in. If a lower hardness is required, the steel can be employed in the solution-quenched state, without ageing. The new steel is said to have superior resistance to corrosion as compared to 18-8 stainless steel when subjected to certain specified corrosive acids.

The question of valve packing becomes increasingly important as steam power plants are designed to operate at higher temperatures, up to 1,050 deg. F., and pressures up to 1,500 lb./sq. in. Brass and copper-wire-reinforced asbestos jackets are being replaced for these conditions by a special packing, which consists of a core of asbestos fibre, graphite and a binder, surrounded by an asbestos jacket reinforced with nickel copper alloy wire. At even higher temperatures up to 1,200 deg. F., packings are reinforced with a nickel chromium alloy, which not only provides high strength, but offers in addition, exceptionally high resistance to oxidation and sulphur attack.

A corrosion and heat-resisting nickel molybdenum base alloy has been developed for parts and assemblies such as turbine shrouds and seals where oxidation resistance up to 870 deg. C., good strength up to 650 deg. C., and a low coefficient of thermal expansion are required. The steel has the following typical composition : carbon 0.12 per cent. max. ; silicon 1.0 per cent. max. ; manganese 1.0 per cent. max. ; chromium 4 to 6 per cent. ; molybdenum 23 to 26 per cent. ; iron 4 to 7 per cent. ; vanadium 0.6 per cent. max. ; cobalt not more than 2.5 per cent. ; the cobalt and nickel making up the balance.

The cracking of austenitic steels in the form of cold-drawn tubes has presented a serious problem. The type of steel used is an 18-10 chromium nickel stainless steel containing niobium, and it has been found to crack transversely when heated for intermediate softenings. The tubes have an external diameter of $5\frac{1}{2}$-in., and it is believed that the cracking is associated with intergranular carbides precipitated when the steel is under stress. To cure the trouble, all large tubes made in this type of steel are being heated at 850 deg. C. for one hour before each cold-drawing operation, after the usual intermediate softening at 1,050 to 1,100 deg. C.

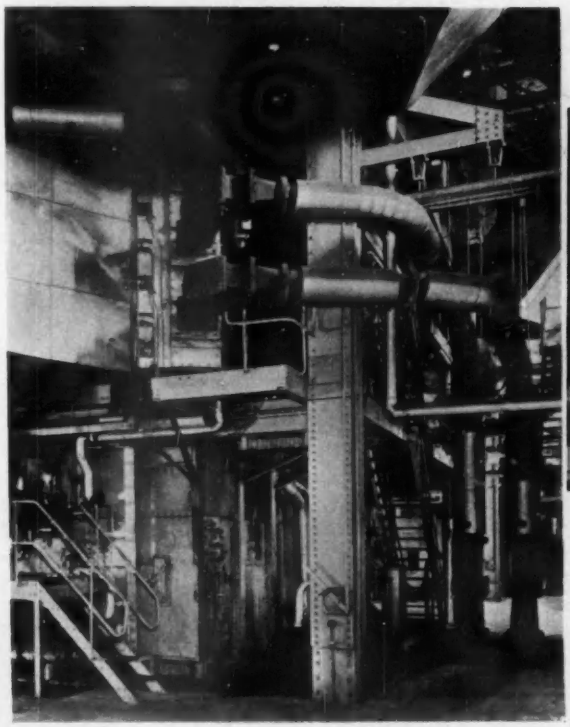
Precipitation-hardening stainless steels have been developed to meet a demand for materials offering the high degree of corrosion resistance typical of the standard austenitic chromium nickel steels, but capable of being hardened by heat treatment. The steels consist of carefully proportioned amounts of chromium and other alloy elements, such as aluminium, copper, molybdenum and titanium, in various combinations.

Stainless steel is now being polished by exposure to gaseous mixtures of various compositions. The best gas composition would appear to be nitric oxide 30, hydrogen chloride 60, steam 10, mol. per cent. The process is of German origin, oxygen or air being the carrier for the introduction of the steam constituent. The best results have been achieved when the operation is carried out at a temperature of 50 deg. C. for approx. half an hour.

Clarke, Chapman & Co Ltd.

— Progress during 1957

DURING 1957 the Steam Generating Division of Clarke, Chapman & Co. Ltd. completed and put into commission the following units. At Goldington power station, Nr. Bedford, of the Central Electricity Generating Board, one large radiant heat water-tube boiler of 300,000 lb./hr. capacity. operating at a pressure of 625 lb./sq. in. at the superheater outlet, and with a final steam temperature of 865 deg. F. The unit to which reference was made in the description of Goldington power station published in the September, 1957 issue of this journal, is fired with pulverised fuel by the Clarke, Chapman system, incorporating three " Raymond Bowl " mills, each having a capacity of 9 tons/hr., the arrangement being for two mills working, and one standby, together with one Clarke, Chapman " Resolutor " mill of smaller capacity for boiler lighting-up purposes. Ancillary equipment includes superheaters with automatic steam temperature control, economiser, dual " Howden " rotary airheaters and forced and induced-draught fans, " Davidson's " cellular type mechanical dust collector, " Sturtevant " electrostatic dust precipitator, " Clyde " soot blowing equipment, mountings, instruments for fully automatic boiler control and feed-water treatment plant. The complete contract includes six identical boiler units, five of which are now commissioned. The final unit (No. 6) is due for commissioning during the early part of this year.



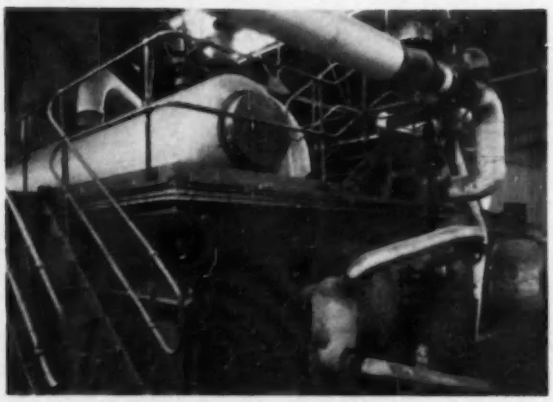
At Grimethorpe Colliery power station, Nr. Barnsley, of the National Coal Board, three large bi-drum radiant heat water-tube steam generating units, each of 150,000 lb./hr. capacity, operating at 425 lb./sq. in. with a steam temperature of 820 deg. F., have been commissioned. Each unit is fired by travelling-grate stokers, using coal, coal-coke breeze mixture, or inferior mixed fuels. Equipment includes controlled type superheaters, economiser, air-heater, dust-collectors, mechanical draught plant and fully-automatic boiler control equipment. The complete contract includes five units of identical capacity, the remaining two units, with provision for coke-oven gas firing, are due for commissioning early this year. Another installation for the National Coal Board is that at Bowhill Colliery, Fifeshire, where one bi-drum water-tube boiler unit of 60,000 lb./hr. capacity, operating at 215 lb./sq. in. and arranged for burning slurry or slurry-duff mixture as fuel, and fired by a " Martin " sloping-grate mechanical-stoker was commissioned during the year. The equipment includes fuel-bunker with multiple-screw conveyors for feeding the fuel on to the grate, water-cooled furnace, superheaters, economisers, dust-collector, mechanical draught plant, and ash-ejector to conveyor. This unit is additional to three 40,000 lb./hr. coal-fired units for Bowhill which have already been supplied.

At Brancepeth Colliery and Coke Works Co. Durham, one tri-drum water-tube boiler of 20,000 lb./hr. capacity,

(Left). View at operating floor level of one of the Clarke, Chapman & Co. Ltd., 300,000 lb./hr. boilers which were commissioned during 1957 at the Goldington power station of the Central Electricity Generating Board.

(Above). The tube wall of one of the three 150,000 lb./hr. Clarke, Chapman bi-drum boilers, during construction at the Grimethorpe Colliery power station of the National Coal Board.

operating at 160 lb./sq. in., with a final steam temperature of 475 deg. F. was commissioned. The unit is fired with coal, coal and coke breeze mixture (on the sandwich system) or with coke-oven gas. With the exception of the firing aisle, the boiler is entirely in the open. The unit is complete with economiser, grit-collector and mechanical-draught plant. The contract included building work, foundations, bunkers, coal and ash conveyors and water-treatment plant.



(Left). A drum-level view of one of the two Clarke, Chapman, 60,000 lb./hr. boilers during course of erection at the Carrongrove Paper Mills, Denny, Stirlingshire.

For industrial power and process requirements, the company installed and commissioned during the year at Carrongrove Paper Mills, Denny, Stirlingshire, two tri-drum water-tube, steam generating units each of 60,000 lb./hr. capacity, operating at 375 lb./sq. in., with a final steam temperature of 780 deg. F. The units are of ample capacity giving an abundance of steam for power or process work, and are fired by travelling-grate stokers using coal as fuel. Each unit is complete with superimposed steam receiver, water-cooled front and side furnace walls, suspended arches, superheater, economiser, cellular dust-collector and mechanical draught plant.

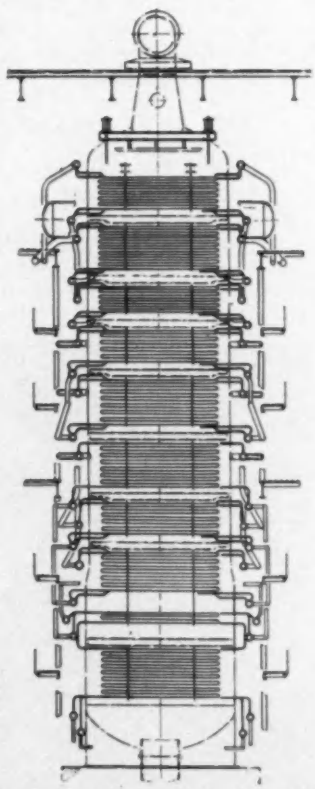
The complete contract includes three identical units, two of which are now commissioned. The remaining unit, No. 3, is to be commissioned early in 1959.

At Chesterfield Technical College, one small oil-fired, bi-drum water-tube boiler, specially arranged for educational use, was installed. The unit is designed to operate at a working pressure of 150 lb./sq. in. with a final steam temperature of 470 deg. F., evaporating 1,800 lb./hr., from feed at 223 deg. F. The Wallsend low air pressure system of oil-firing is used, and includes service tank, electric oil-heater, "Arca" steam/oil regulator, blower and low-pressure air-jet burner. The furnace front wall is water-cooled, and the unit is complete with superheater, economiser (having gas by-pass), moutnings and suitable experimental recording instruments.

Clarke, Chapman & Co. Ltd. are also installing numerous boiler units for commissioning during 1958. These include two oil-fired bi-drum radiant heat water-tube steam generators for Thames Board Mills Ltd., at their Mersey Works, Warrington, supplying steam for power or process work. Each unit will generate 150,000 lb./hr. of steam at a working pressure of 600 lb./sq. in. with a final steam temperature of 800 deg. F. The first unit is being placed in service at once, and the second unit within the next few weeks. Each unit is complete with fully water-cooled furnace, controllable superheater with surface-type desuperheater, economiser, mechanical draught plant, mountings and instruments for fully-automatic boiler control.

For the National Coal Board, at Murton Colliery, Co. Durham, coal carbonisation plant, three coal-fired bi-drum water-tube, steam generating units are being erected. They will supply steam for power and process work; each unit will have an evaporative capacity of 20,000 lb./hr. at 615 lb./sq. in. and 815 deg. F. steam temperature. Each unit is provided with a mechanical chain-grate stoker for coal-firing and burners are fitted to each furnace side wall for alternative coke-oven gas firing. The furnace front and rear walls are water-cooled. The ancillary equipment includes superheater, economiser, grit-collector and mechanical draught plant, mountings and instruments.

For installation overseas there are three coal-fired tri-drum water-tube steam generators, each of 50,000 lb./hr. capacity, the steam pressure and temperature being 400 lb./sq. in. and 770 deg. F. respectively. Two of the units are being installed at the Gwalior Rayon Silk Manufacturing (Weaving) Co. Ltd., at Nagda, India, and one unit is being installed in a cement works at Patna in a neighbouring state. Each unit is complete with travelling grate stoker, water-cooled front and side furnace walls, superheater, economiser, mechanical draught plant and grit-collector.



(Right). An outline arrangement of one of the twelve steam generator units being constructed by Clarke, Chapman for the Bradwell nuclear power station.

Orders received by the company during 1957, and due for commissioning in 1958, include:—one tri-drum water-tube steam generator for the Northern Gas Board,

(Tyneside Division), Redheugh Works, Co. Durham. This unit of 35,000 lb./hr. capacity, at a working pressure of 175 lb./sq. in., is identical with two units previously supplied and commissioned in 1948. The three units provide steam for general processes and are provided with fully-automatic control equipment. They are fired with low-grade gas-works coke-breeze by chain-grate stokers. The equipment includes superheater, air-heater, mechanical draught plant, mountings and instruments.

Two small oil-fired bi-drum water-tube, steam generators are being installed for the United Kingdom Atomic Energy Authority, at Dounreay. Each unit has a capacity of 5,000 lb./hr. and is arranged to operate at either 350 or 100 lb./sq. in. They are fired by the Clyde rotary oil-burner system.

Orders have also been received by Clarke, Chapman & Co. Ltd. for the following :—two oil-fired radiant heat steam generating units for the Londonderry power station, Coolkeeragh, of the Electricity Board of Northern Ireland. Each unit is designed to generate 380,000 lb./hr. of steam at a working pressure of 625 lb./sq. in. and a temperature of 870 deg. F., from feed at 340 deg. F. These units, which are due for commissioning in 1959, have fully water-cooled furnaces with close-pitched tubing, external downcomers, single steam and water drum, controllable superheaters and spray de-superheaters, economiser, dual air-heaters and mechanical draught plant, with provision for cellular dust-collectors, and complete oil-firing equipment together with fully automatic boiler control.

An account of the work of the Steam Generating Division would be incomplete without reference to the twelve steam generator units which the company are constructing for the 300-MW Bradwell nuclear power station of the Central Electricity Generating Board, due for commissioning in 1960. Each unit comprises one high-pressure and one low-pressure steam drum, high- and low-pressure economisers, high- and low-pressure evaporators, high- and low-pressure superheaters, external circulating pipework, integral pipework and steam pipes, high- and low-pressure circulating-pumps, drum internal fittings, mountings, instruments, etc. In addition to the steam generators, Clarke, Chapman will also manufacture and erect the structural steelwork for the four boiler rooms housing the steam generators, together with part of the expansion joints of the CO_2 coolant ducting.

A BOILER FURNACE INSPECTION PLATFORM

A movable platform suitable for inspection and light repair work inside the furnaces of large land boilers and similar structures has been developed jointly by Foster Wheeler Limited, London, and Non-Corrosive Metal Products Limited, Yiewsley. It is the subject of British Patent Application No. 9633/55. The platform has been designed to replace the scaffolding normally used for such purposes and it considerably reduces assembly time and manpower. A number of such platforms have been ordered and the first set to be supplied to the Central Electricity Generating Board has been in use in the furnaces of the Foster Wheeler boilers at Wakefield "B" Power Station.

One of the four light-alloy davits from which the platform furnace inspection is suspended by means of steel-wire ropes.

In four light-alloy sections, the platform provides a 15-in. wide staging around the furnace walls, and allows access up to the furnace roof when the platform is in its highest position. The platform sections, which are easily manhandled, are interlocked during assembly to form a single unit, in the shape of an open square, which is raised and lowered manually. The lifting tackle is operated from the platform itself at each corner. Articulated joints between the sections allow for a certain amount of uneven working of the lifting tackle without throwing an undue load on any particular suspension wire. The platform is suspended by steel-wire ropes attached to four light-alloy davits, which are assembled in four access openings provided in the upper part of the furnace. The desirable size of these openings is about 54-in. high by 21-in. wide, and care has been taken to ensure that the minimum uncooled furnace wall surface is presented when the furnace is in operation. The davits are so designed that the platform sections and personnel can pass through them when entering or leaving the furnace. They are fitted with service winches, which are used during assembly of the platform. Powerful electric floodlights on swivel moutnings are fitted to the davits for lighting the interior of the furnace during operations. The weight of the empty platform is counterbalanced, thus relieving part of the ultimate load on the davits and lifting tackle. Made from standard parts, the platforms are designed to suit each particular application. Although initially designed for use in a Foster Wheeler boiler, the platform is not restricted to this application.

The platform is assembled by fitting the four davits in the access openings and launching the main platform sections into the furnace between opposite pairs of davits. The shorter transverse sections are then passed into the furnace and are connected to the adjacent ends of the main sections, thus forming an open square. The reverse procedure is used for dismantling. Where the upper part of the furnace is constricted, by a slag-screen for instance, means are provided to move the platform close to the wall below such a projection.

The davits are provided with safety bars to prevent personnel falling into the furnace when the platform is in the lowered position and during assembly and dismantling. The platform is provided with handrails, kickplates and non-slip floor, while special precautions have been taken to guard against corrosive conditions inside the furnace. Assembly of the platform is carried out in the upper part of the furnace adjacent to the roof, thus enabling dangerous slag to be cleared before work commences further down.

Tests on a Cochran Sinuflo Economic Boiler

RECENTLY we had the opportunity of visiting the boiler plant at the London Co-operative Society's Dairy, at Palmers Green, London, where a performance test carried out on one of the boilers installed there gave an efficiency of 80.6 per cent. The unit in question is a Cochran Sinuflo Economic boiler made and supplied by Cochran & Co., Annan, Ltd., and designed for an evaporative capacity of 11,400 lb./hr. from feed at 60 deg. F. It is 9-ft. 0-in. dia, by 15-ft. 8-in. over tube plates, with a heating surface of 1,499 sq. ft., and operates at a pressure of 150 lb./sq. in. The boiler has two 2-ft. 9-in. dia. flues, and is oil-fired, the oil-burning equipment comprising two Wallsend Hubbard low-pressure air hand-controlled burners. The furnaces are lined with 1½-in. thick firebrick apron 4-ft. 6-in. long spanning an arc of 120° along the lower part of the furnace. A refractory wall 15-in. high is fitted in each furnace at a distance of 9-ft. 0-in. from the front. A forced-draught fan is provided for the atomising air supply, the secondary air being drawn through air directors by the boiler induced-draught fan which is of Sturtevant Company's manufacture, and driven by a variable speed motor. The boiler, which has been in service for about six years, is one of a range supplying steam to the dairy and laundry, and for the purpose of the test was set and operated by the operating staff under normal working conditions without interference of any kind by the test team.

The Cochran Sinuflo Economic boiler

The induced-draught Sinuflo Economic boiler, incorporating Kirke patents, is designed to bridge successfully the gap between the larger sizes of Cochran vertical boilers and the smaller types of water-tube boiler. The unit is of the horizontal multitubular dry-back type, and the standard design operates with induced draught—both the fan and its driving motor being mounted on a platform attached to the top of the boiler shell. The boiler is self-contained, and requires no brick setting. The boiler shell is made with two strakes or belts and is Class I welded.

The boiler is fitted with a single pass of "Sinuflo" tubes, whose high transmission efficiency makes it unnecessary to fit a double pass. Thus the gases passing through the tubes are made to impinge upon, and the heat contained in each molecule is positively hammered into, the surfaces of the tubes. In a straight tube, a core of gases may pass through without coming into contact with the tube wall; the turbulence inevitable inside a "Sinuflo" tube prevents such an occurrence. The "Sinuflo" tube is claimed to do the work of a straight tube of more than double its length. A very large brick-lined combustion chamber, 7-ft. 0-in. long in the larger sizes, is fitted to the boiler. Brick arches project into this chamber from the exits of the furnace flues; hot gases are thus compelled to travel to the back of the chamber before entering the tubes. Both space and time are thus given for the desired complete combustion, which is greatly assisted by the large mass of hot brickwork. The design allows for smoke emission from the boiler to be eliminated, as the result of the efficient combustion. The reduction in the velocity of the gases causes a large proportion of the grit to be deposited in the bottom of the chamber, whence it is easily withdrawn through a hinged door.

The Cochran induced-draught Sinuflo Economic boiler can obtain evaporation as high as 10 lb. of steam per hour per square foot of heating surface, whilst still retaining its thermal efficiency; a natural draught boiler, when fed with coal, may produce about 6 lb. of steam per hour per square foot of heating surface, according to figures published by the British Coal Utilisation Research Association. This difference is due, mainly, to the patent Sinuflo tube fitted in all Cochran Economic boilers. Evaporative capacities range from 6,000 to 30,000 lb./hr. of steam from and at 212 deg. F. Sizes from 6-ft. 6-in. to 12-ft. 6-in. in diameter are standard production, larger units being limited in size only by difficulties of transport.

Two tests were carried out on the boiler at the London Co-operative Society's Dairy at Palmers Green, viz.:—light load and full load tests respectively, and these tests were carried out strictly in line with B.S.I. codes so far as the codes are applicable. At the same time, the tests were standard commercial type investigations.

The calorific value of the fuel oil was based upon a

Two Cochran Sinuflo Economic boilers at the Palmers Green dairy of the London Co-operative Society. The tests referred to were carried out on the unit shown on the right of the illustration.

sample sent by Cochran & Co., Annan, Ltd., to the West Ham Testing Laboratory, and from a sample taken by Shell-Mex and B.P. Ltd., and tested by that company. The British Coal Utilisation Research Association submitted details of their analysis of the continuous gas samples taken during the tests. Measurements of fuel oil supply to the L.H. burner was obtained by the new George Kent meter, and that to the R.H. burner by the new meter manufactured by Measurement Ltd. After the tests the meters were calibrated by Shell Petroleum Company with the following results :—

Meter	Fuel temp.	Actual flow rate	Flow as measured by meter	Percentage difference
	(deg. F.)	(g.p.h.)	(g.p.h.)	(per cent.)
Kent	190.5	46.5	46.1	0.87
Measurement Limited ...	190	47.85	48.7	1.95

Feedwater supply was measured by a George Kent Ltd. meter, which had been checked and overhauled by the makers prior to the tests. Calibration tests after the boiler tests showed the meter to be giving correct and accurate readings. Analysis of flue gases was made by Orsat apparatus, and combustion chamber temperatures by a Foster indicating pyrometer. All other temperatures were measured by "mercury-in-glass" thermometers and draught measurements by U-tube gauges.

The following figures were obtained during the main or full-load test which was of six hours' duration.

Fuel Oil

Specific gravity at 60 deg. F.	0.9579
Viscosity at 100 deg. F. (secs.)	922

Ultimate Analysis

Carbon	(per cent.)	85.35
Hydrogen	" "	11.01
Oxygen	" "	0.85
Nitrogen	" "	0.11
Combustible sulphur	" "	2.66
Incombustible sulphur	" "	Nil
Ash	" "	0.02
Water		Trace
		100.00
Gross calorific value	B.Th.U./lb.	18.693
Nett calorific value	" "	17.736

Test Data

Duration	6 hours

Fuel

Temperature at burners	(deg. F.)	193.5
Oil pressure	(lb./sq. in.)	10.4
Total oil recorded by L.H. Meter	(gall.)	276
Actual oil passed = $276 \times \frac{46.5}{46.1}$	"	278.4
Total oil recorded by R.H. Meter	"	293.4
Actual oil passed = $293 \times \frac{47.85}{48.7}$	"	288.3
Total oil consumed by both burners	"	566.7
Specific gravity of oil at meter		0.9102
Total oil consumed	lb.	5,171
Average oil consumption	"	861.8

Water

Temperature at meter	deg. F.	145
Total water through meter	gall.	7,280
	lb.	71,550
Total water per hour	"	11,925
Evaporation per lb. of fuel	"	13.84

Steam

Average steam pressure	lb./sq. in.	128
Temperature of steam (from tables)	deg. F.	353
Total heat of steam per lb. from feed at 145 deg. F.	B.Th.U.	1081.3

Flue gases

Average temperature in combustion chamber	deg. C.	965
	" F.	1769
Temperature of gases in smokebox	" F.	545
CO_2 content of gases in smokebox	per cent.	14.2
O_2 content	" "	2.1
CO content	" "	Nil
Excess air	" "	10.9
Weight of dry flue gases per lb. oil		15.138
Weight of moisture of combustion per lb. oil		1.000
Total weight of products per lb. oil		16.138

Air

Boiler house temperature	deg. F.	91
Outside temperature	" "	68

Draughts

Suction in smokebox	in. W.G.	1.9
Suction in combustion chamber	" "	0.6
Burner air pressure	" "	16.0

Results

Average actual evaporation	lb./hr.	11,925
Average evaporation from and at 212 deg. F.	lb./hr.	13,280
Percentage of full rating	per cent.	97
Efficiency on gross calorific value of fuel	" "	80.60
Efficiency on nett calorific value of fuel	" "	85.44

Heat Balance on Gross Calorific Value of Fuel

Heat to steam	(per cent.)	80.60
Heat to dry gas	" "	9.37
Heat to moisture of combustion	" "	6.84
Radiation and other losses	" "	3.19
		100.00

In conclusion, our acknowledgments are due to the London Co-operative Society for granting us permission to visit the plant and to publish the boiler test figures. We should also acknowledge the co-operation which we have received from Cochran and Company, Annan, Ltd.

NEW BOOK

"Standard Handbook for Electrical Engineers." *(Ninth edition.) Editor-in-Chief, Archer E. Knowlton. 2,230 pages. Text area 4½ in. × 7¼ in. Published by the McGraw-Hill Publishing Co. Ltd., 95, Farringdon Street, London, E.C.4. Price 124s.*

This well-known American work of reference includes contributions from over 100 recognised authorities on a variety of subjects, in all fields of electrical engineering practice, including communications, transport, electric heating (including welding), electro-chemistry, illumination, nuclear power, elevators and mine hoists, lighting protection, together with power plants, power transmission, distribution, instrumentation and control. The present edition includes much new information, that of particular interest being in the fields of transistors, nuclear power, dielectrics for capacitors, synthetic resins and plastics, electrical measurement for automation, lighting, metals such as titanium and zirconium, new international electrical units and valves, and magnetic amplifiers in motor control. The subject matter is arranged progressively from units, definitions, circuits and machinery theory to the various fields of their application, the whole being designed to serve the specialist in one field who seeks a clear understanding of the theory and established practice in a similar field with which he may have limited experience. Finally there is included a most comprehensive index which contains numerous cross-references to enable items to be found from more than one approach.

RECENT Equipment AND Accessories

New Multelec recorder

George Kent Ltd. announce that their Mark 2A Multelec recorder, originally developed for, and sold exclusively to the atomic-energy industries, is now to be made generally available to all industries. Applications suggested for the Mark 2 are temperature measurement (thermocouple or resistance thermometer); direct millivoltage recording; industrial measurements depending on a radioactive source and ionisation gauge, such as of level, material thickness, density, etc.; and for research work. The instrument has been designed primarily as a single-point recorder, enabling measurement to be made at high speed. Three different types of built-in amplifier are available, the type used depending on the application. Type 1 is used for d.c. millivolt or temperature measurement, using thermocouples. The minimum instrument range is 1 millivolt d.c. from a low- or medium-resistance source. The following components are mounted inside the case:-filter unit, synchronous converter, and reference unit, to provide a continuous stabilisation of the slidewire current against a standard cell. This amplifier can also be used for temperature or temperature-difference measurement (using non-inductively wound resistance thermometers). The filter unit, reference unit and standard cell are then replaced by a d.c. power pack which feeds the Wheatstone-bridge circuit.

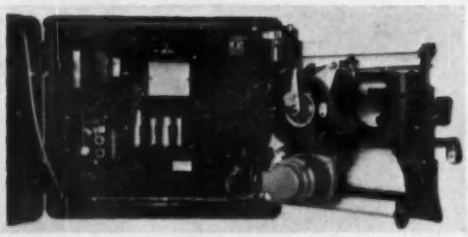


Fig. 1. The Kent Mark 2A Multelex recorder, showing the instrument with the door and main frame in the open position. (George Kent Ltd.)

Type 2 is for a.c. measuring circuits of low or medium impedance, when a synchronous converter is not required. Type 3 is for the measurement of d.c. voltages from sources of high resistance, the minimum instrument range being 30 millivolts and maximum external resistance, 10 megohms. This amplifier requires a filter unit, synchronous converter, reference unit and standard cell. The recorder, complete with Type 1 or Type 3 amplifier, can be used in conjunction with an accurate current resistor. An external range-change unit containing up to six resistors is available, provided with an external switch, to measure up to six different ranges of current. Pen speeds are 2 or 20 sec. nominal full-scale, and chart speeds 1, 2 or 3 in. per min. or per hour. Sensitivity is said to be better than ± 0.1 per cent., and accuracy ± 0.3 per cent. of full scale ± amplifier zero offset. (*Geo. Kent Ltd., Luton, Bedfordshire.*)

Tube expansion control equipment

An entirely new concept in tube expansion control equipment has recently been made by the Airetool Manufacturing Company with the introduction of a uniquely designed, pneumatically-operated Airetrol tube expansion control. Perfected after a considerable amount of planning, designing and testing, this new precision instrument is claimed to automatically control tube expansion by accurate measurement of torque, rolling up to 12 tubes per min. to uniform accuracy. Airetrol completely eliminates guesswork in tube rolling by combining Airetool's rugged air-motor drive with a precision control that measures torque output. Accurate to within 0.001 of an inch, the Airetrol tube expansion control automatically stops expansion according to a predetermined setting. This, it is stated, results in uniformly tight tube joints with no over expansion or under expansion—this extreme accuracy being obtained through the sturdy, torque sensing mechanism which is entirely unaffected by fluctuations in air pressure. A primary advantage of this tube expansion control is that it insures maximum tightness and holding strength in every tube joint in the condenser or heat-exchanger, and also prevents distortion or breakage of ligaments in the tube sheets. Airetrol's finger-tip micrometer adjustment is quickly set to the desired torque without using any tool, and the calibrated ring permits setting as low as 0.5-ft./lb. and up to 37-ft./lb. torque at 90-lb./sq. in. Three Airetrol models are available for tube sizes ranging from ¼-in. to 1½-in. o.d. All three may be used in rolling both steel and non-ferrous tubes. The Airetrol housing is colourfully anodised, and all steel parts are treated to resist rust, corrosion and general wear. Air operation of Airetrol is claimed to make it extremely economical to operate and cuts maintenance costs. Another important feature is that it is entirely safe to use in hazardous or fire-zone areas. (*The Airetool Manufacturing Co., Springfield, Ohio, U.S.A.*)

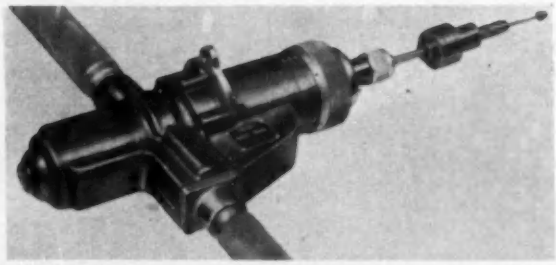


Fig. 2. The new pneumatically operated Airetrol tube expansion control unit. (The Airetool Manufacturing Co.)

Hosepipe assembly vice

To facilitate the fitting and renewal of connections to hosepipes, the Consolidated Pneumatic Tool Co. have introduced a new piece of equipment which consists of a 2½-in. diameter single-acting, spring-return cylinder with a 3-in. stroke piston, the cylinder being mounted on a baseplate with a hose clamping vice facing the cylinder and piston, and mounted on the same baseplate. The two jaws of the vice are fitted with removable inserts to accommodate different diameters of hose-

pipe. Air control is achieved through a single-acting, hand-operated valve, to which is fitted a CP air-flow regulator. Sleeves are supplied for the piston rod to suit various types of hose fittings. Operation of the unit consists of gripping the hose-pipe in the vice, fitting a hose connection to the piston rod and operating the air-valve, and, the company say, experience has shown that a connection can be adequately pressed home even in a high-pressure reinforced hydraulic hose. Where nuts are fitted to the hose clamp, a further saving in time is effected by using a small CP-344 nut runner fitted with a socket to suit the size of nut used. (*Consolidated Pneumatic Tool Co., 232, Dawes Road, London, S.W.6.*)

New flame-failure equipment

The FSM4 flame-failure and ignition programming control unit recently introduced by Elcontrol Ltd. is a fully-automatic controller for use with practically any type of industrial oil or gas-burning equipment that is required to start up automatically by remote control or time clock. The viewing head used with this system is the VH31P—a cast aluminium unit embodying an infra-red sensitive cell, designed for fitting into a 2-in. dia. viewing tube, and complete with 6-ft. flexible cable connection terminating in a junction box. The head may be used up to 100-ft. from the control unit. Within the control unit are contained an electronic flame-detecting circuit into which signals are fed from the viewing head, associated with a system of relays and a synchronous motor-driven programming unit. This combination is so arranged that on a demand for heat (from a time clock or thermostat or combination of both), lighting-up takes place in the correct pre-determined sequence. If any part of the sequence does not take place in the correct manner or within the time prescribed, the whole heating appliance is shut down and an appropriate alarm is given. In addition, should flame failure occur during normal operation, the fuel is immediately shut off and the alarm is given. No automatic relight attempt is provided as this is considered undesirable for the larger industrial type of installation for which this unit is designed. The control unit can be supplied fitted into a dust and moisture proof sheet-steel enclosure with hinged lid or alternatively into a heavy cast aluminium (or cast iron) weather-proof enclosure with lid securely screwed down and gasketted. As a third alternative, the unit may be supplied in chassis form for mounting into a control cubicle or cabinet. Whatever type of enclosure is employed the chassis uses the plug in form of construction so that it may be easily removed without disturbing any external connections. The FSM4 has been designed for use with burners having direct spark ignition or spark-ignited gas or light-oil pilots which may either remain on or be switched off after establishment of the main flame, and it operates in conjunction with various types of temperature control. The normal power supply is 200/250-V, a.c., single-phase, and all relay contacts are rated at 5-amp, 250-V a.c. non-inductive. (*Elcontrol Ltd., 10, Wyndham Place, London, W.1.*)

Vacuum cleaning equipment

Vacuum cleaning equipment available from New Welbeck Ltd. incorporates a patented device which eliminates the use of a dust bag, and, therefore, ensures more efficient operation as there is a constant suction at all times. This is due to the separation of air and dust before the air passes through the filter, which consequently remains comparatively clean and cannot restrict the air flow, however full the dust container may be. The power units of all Welbeck cleaners are completely protected from dust and dirt, and are suitable for use on any standard voltage (lighting circuit). Special low-voltage power units are available, ranging from 24-volts (for battery supply), and other units for 50, 100 and 110-volts are also available.

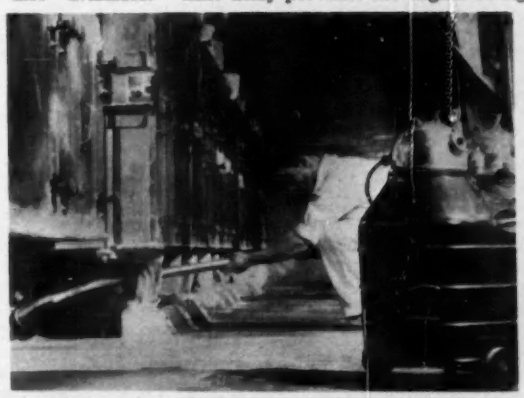


Fig. 3. The Welbeck "Duplex" suction-cleaner is shown here being used to reach awkward locations. (New Welbeck Ltd.)

A new model introduced by the company is the "Floor Master," which is fitted with either two or three detachable twin turbine power units, and with the adequately sized metal canister is mounted on a 3-wheel trolley. This new addition to the existing range of "Simplex," "Duplex," "Triplex" and "Bak-Vac" models can also be used with a flexible hose and accessories for overhead cleaning. (*New Welbeck Ltd., Moulescoomb Way, Brighton, 7, Sussex.*)

Single operator engine-driven welding set

A new diesel-engine-driven arc-welding set (type DEB.400U), a lightweight and relatively small unit, has been added to the range manufactured by Quasi-Arc Ltd. The set has quick voltage recovery, and is said to be particularly suitable for depositing the cellulose-covered types of electrode frequently used in positional pipe welding. The generator is constructed to B.S. 638 : 1954 throughout. The B.S. classification is Group X, and the machine is self-stabilising with drooping characteristics. Field excitation of the welding generator is obtained from a separate belt-driven generator of standard manufacture, mounted on top of the welding generator frame and contained within a flexibly-mounted control box, together with the welding generator control gear. The welding generator is flange-coupled to a 3,610 c.c. Ford four-cylinder water-cooled industrial diesel engine, rated at 40 b.h.p. at 1,500 r.p.m. A feature of the new set is the fully-automatic idling device. Pneumatically operated, it is arranged to reduce the engine to idling speed automatically when welding is not in progress. No switch or other control is necessary on the electrode holder since the flow of welding current controls the device directly. A pre-set adjustable time delay prevents the engine idling during pauses in welding, such as would be encountered when electrodes are changed. The engine rapidly reaches full speed upon the commencement of welding following a period of idling. This device is capable of giving worthwhile reductions in fuel consumption, especially during site welding under difficult conditions, where frequent interruptions of the arc are necessary. The

controls of the welding set are arranged not only for simplicity and safety, but also to give the operator the choice of a large number of volt/amp characteristics, so that he can adjust the welding conditions to suit the job in hand. In standard form the equipment is mounted on a four-wheeled pneumatic-tyred undergear for hand towing ; the two front wheels are steerable and attached to a draw-bar. It can, however, also be supplied mounted on brackets for stationary use, or on a two- or four-wheeled road-towing undergear. (*Quasi-Arc Ltd., Bilston, Staffs.*)

Automatic regulation of coal feeders

The coal feed from a rotary table type feeder is usually regulated by varying the speed of rotation of the table, and numerous methods have been adopted to obtain this variation of speed. Ideally a stepless speed range of zero to maximum is desirable. An alternative method, which achieves the same end, has been in successful operation at Hackney power station for several months. With this system coal feed is regulated by moving the position of the knife by means of a power cylinder gear box, or other form of regulator. The table is then driven at a constant speed. This arrangement is said to offer the following advantages : (a) a stepless range of coal feed from zero to maximum ; (b) it eliminates the necessity for a variable speed motor, or drive, to the feeder ; and (c) continual adjustment of knife position keeps the feeder freer from obstruction. (*George Kent Ltd., Luton, Beds.*)

Level gauges

The latest design of level gauge available from Richard Klinger Ltd., the type R.T.A. 28, is suitable for boiler pressures up to 2,000 lb./sq. in. For some years it has been recognised that use can be made of the different refractive index between glass and water, and glass and steam or air to provide a positive distinction between the steam and water spaces in water level gauges for high-pressure boilers and this has usually been done by fixing the two transparent plate glasses at an angle to each other. In the new R.T.A. gauge the two flat plate glasses have parallel surfaces but are off-set, so that the line of sight through the gauge is not perpendicular to them. The line of sight from an observer is, therefore, diverted to a greater extent when passing through the vapour space than when passing through the water and the two emerging angles strike contrasting surfaces in the illuminator fixed at the back of the gauge. These can be either red and green opalescent glass or a white glass screen and darkness. The illuminator is of perfectly simple box-like construction containing four standard lamps and there are no lenses or reflectors to get out of adjustment. As this level gauge normally requires viewing from a position immediately in front of it, it is best equipped with a mirror, or periscope attachment if it is to be viewed from immediately below. The glasses in the gauge are ground to fine limits and are not subjected to high mechanical stresses when the gauge is bolted together. They are free to adjust themselves to different amounts of expansion when the level gauge is subjected to changes of temperature. (*Richard Klinger Ltd., Sidcup, Kent.*)

An electronic process control installation

The recently installed control installation for continuous diffusers at the British Sugar Corporation's factory at Wissington, in Norfolk, is believed to be the first closed-loop electronic process control installation applied to the process of extracting sugar from sugar beet. It was designed by Evershed & Vignoles Ltd. in conjunction with the British Sugar Corporation, and makes use of a variety of transducers for flow, level, temperature, etc., which provides an electric signal which is either applied to Evershed 3-term process controllers or used as an input to Evershed simple analogue computers. Several of these computers, which are completely integrated into the installation, are employed to provide an output signal which represents the continuous evaluation of the equation governing the part of the refining process to which they are applied. These computers, in conjunction with the three-term mode of process control, permit extremely fine control of the manufacturing process. The graphic control panel, which is the basis of the whole installation, embodies a number of Evershed miniature recorders which provide a permanent record of the performance of the plant, and will also furnish data for accountancy purposes, etc. The control panel also includes Miniplaques, so that bumpless transfer from automatic to manual operation of the plant, when desired, can easily be accomplished. An automatic alarm system, covering the most important section of the plant, also terminates at the panels. In view of the complexity of the process controlled, use has been made of the Evershed " in-line " scanner, which facilitates the supervision of the whole of the plant by a single operator, and which pin-points the location of any possible irregularity at once. (*Evershed & Vignoles Ltd., Acton Lane Works, Chiswick, London, W.4.*)

Free-end hose coupling

Airtech Ltd. have now made available a new hose coupling for use with low and medium-pressure compressed-air and fluids, which, they say, offers the advantages that it forms a one-piece unit which need never be dismantled ; no preparation of the end of the hose is required ; no tools of any description are required for fitting or removing the hose ; and there are no separate bolts, nuts, clips, screws, inserts, ferrules, etc. It is also pointed out that for a given inside diameter of hose, a given coupling can accept varying wall thicknesses, and that the hose can be entered or removed as often as required. The average time for effecting a joint is said to be approximately 10 sec. Two types of couplings manufactured in nylon and suitable for working pressures up to 250 lb./sq. in. are available. With type " D," for the purpose of joining two lengths of rubber or plastic hose, the free end of a piece of hose is inserted into each end of the coupling ; the body portion of the coupling is then screwed up by hand until the two hoses are securely locked. In this process the hose is progressively gripped by an internal helical steel spring which is reduced in diameter in a conical section of the body. The type " S " coupling is threaded for attachment to a tool, or to a supply where the coupling can remain permanently. The other end accepts the free-end of the hose which is locked tightly by screwing home the body portion by hand, and is as quickly removed. Similar couplings manufactured in brass will, the company state, shortly be available. (*Airtech Limited, Engineering, Haddenham, Bucks.*)

Export of electric motors

Although the bulk of export orders handled by Laurence, Scott & Electromotors Ltd. during 1957 have gone to the larger English-speaking countries, worth-while business has been gained by the company in countries as far apart as Venezuela, Malaya and Japan. A considerable proportion of the export total to Australia has been in the form of motors for power station auxiliaries, including two 900-h.p. cooling-tower pump motors for Yallourn " E " power station, and numerous motors for Wallerawang power station including four 485/27-h.p. and four 218/13-h.p. N-S variable-speed motors for the

station i.d. and f.d. fans respectively. Four other large units for Australia were 1,600-h.p., "Trislot," 490 r.p.m., water-cooled, high-torque, low-current, squirrel-cage motors for a pumping station, while other interesting orders were a 700-h.p. N-S variable-speed a.c. motor, arranged for reversing and for inching in both directions, for driving a cable belt-conveyor, and a batch of 40/40 d.c. motors for wire drawing machines. A number of motors of substantial size (up to 1,250 h.p.) are being supplied to Canada for power stations, together with slip-ring motors to Canadian C.S.A. Class 2, groups F and G hazards, requirements. In a number of countries variable-speed units with special automatic control equipment, and ranging in size from 5 to 900-h.p., have been supplied for the production of synthetic fibres and similar materials. The company has also obtained orders from American oil companies in the face of competition from U.S.A. motor manufacturers; these include a number of motors from 150 to 350-h.p. In many instances L.S.E. control equipment has been supplied for use in conjunction with the machines mentioned, together with L.S.E. automatic control devices. So called invisible export business includes the manufacture of equipment of the company's designs under licence in a number of countries, including the U.S.A. (*Laurence, Scott & Electromotors Ltd., Manfield House, Southampton Street, Strand, London, W.C.2.*)

DRY COOLING TOWERS

A cooling system which makes it possible to site power stations where large volumes of cooling water are not available, or can only be provided at excessive cost is being developed by The English Electric Company Limited. (Negotiations for the design and construction of a commercial-scale installation were announced recently by the Central Electricity Authority: see ENGINEERING & BOILER HOUSE REVIEW, January, 1958, page 23.) The plant uses a system proposed by Professor L. Heller, of Budapest University, and Mr. L. Forgö, in a paper delivered at the last World Power Conference in Vienna. The essential features are the injection of pure water into the steam and the cooling of the mixture of water and condensate by air in large heat-exchangers fitted round the base of the cooling tower. The system is to be closed and the circulating-water of condensate purity; the plant should therefore be free from internal corrosion troubles. The flow of air through the cooler is produced by either induced draught fans or natural draught, the choice depending on such factors as fuel cost, atmospheric temperature and size. Two factors contribute to overall economy; the cooler, which is made entirely of aluminium and is simple, effective and cheap, and the spray condenser, which eliminates the drop in temperature between the condensate and cooling water that occurs in the conventional condenser. The English Electric Company's studies indicate that as soon as cooling water becomes a special problem for any reason, the new scheme will quite frequently be more economical than the normal systems.

INSULATION EXHIBITION

More than thirty leading firms and associations in the insulation field will be represented at the Thermal Insulation Exhibition, which is to be held at Earls Court, London, from April 14th-19th, 1958, in conjunction with the sixth Factory Equipment Exhibition. The Thermal Insulation Conference which is being held as part of the exhibition will be opened by Mr. Gerald Nabarro, M.P., originator of the Thermal Insulation (Industrial Buildings) Act. In the morning and afternoon sessions, talks on the statutory, financial and practical aspects of industrial insulation will be given by a panel of experts. Representatives of the British Standards Institution, the Federation of British Industries and the Royal Institute of British Architects have now joined those of nine other organisations on the Advisory Committee for the Conference. Twelve Government, professional and trade organisations are thus co-operating. Among those who have already booked stand-space in the Thermal Insulation Exhibition is the Building Research Station, whose stand will deal with architectural problems in insulation. FIDOR will indicate in general terms the applications of fibre building boards. The British Plasterboard (Manufacturing) Ltd., Gyproc Products Ltd., Imperial Chemical Industries Ltd. and Plaster Products (Greenhithe) Ltd. will each have representatives on the stand of the Gypsum Plasterboard Development Association. Other well-known firms who will be exhibiting insulation materials and systems include Atlas Asbestos Cement Co. Ltd., Baxenden Chemical Co. Ltd., Burgess Products Co. Ltd., Cape Building Products Ltd., Celotex Ltd., Central Asbestos Co. Ltd., Chemical & Insulating Co. Ltd., Darlington Insulation Co. Ltd., Draftsele Ltd., Expanded Plastics Ltd., Expanded Rubber Co. Ltd., Fibreglass Ltd., Jablo Plastics Industries Ltd., Kapok Ltd., Lignacite Ltd., Newalls Insulating Co. Ltd., Onazote Insulation Ltd., J. W. Roberts Ltd., Roof & Lining Construction Ltd., Sprayed Insulations Ltd., Stramit Boards Ltd., Tentest Fibre Board Co. Ltd. and the U.A.M. Group, including the Universal Asbestos Manufacturing Co. Ltd. and U.A.M. Plastics Ltd.

* * *

We have received from the **British Iron and Steel Research Association**, 11, Park Lane, London, W.1, a copy of the 1957 edition of the *BISRA Survey*, the contents of which reflect the current interest in process control and automation. Attention is drawn to four technical articles of particular interest. These discuss the progress in forge mechanisation; a new system of translator control; a completely new system for the measurement of rolled rods, forgings, etc., at red-heat; and a novel approach to blast-furnace design.

* * *

During the recent tour of Great Britain made by the Canadian Trade Mission, some of the members visited the Wolverhampton works of **John Thompson Limited.** The visitors were received by Mr. H. N. Thompson (joint managing director, John Thompson Limited) and directors representing companies in the John Thompson Group. An extensive tour of the factories introduced the delegation to all aspects of John Thompson manufactures. Special interest was shown in the production of heavy steel vessels for the Berkeley nuclear power station, Gloucestershire, which as partners in the A.E.I.-John Thompson Nuclear Energy Company Limited, the company is building for the Central Electricity Generating Board. The visitors also saw work in progress on vessels and process plant for the chemical and petroleum industries, and on chassis-frames and smaller motor vehicle components for which John Thompson Motor Pressings Company has held contracts since the turn of the century. A late feature of the itinerary was a visit to John Thompson (Pipework) Limited, factory, where stainless-steel pipework for the primary and secondary heat-exchange circuits was manufactured for the Dounreay fast-breeder reactor station of the United Kingdom Atomic Energy Authority and where, currently, pipework for the Berkeley contract is being made.

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The Governing Board of the National Institute for Research in Nuclear Science announce that they have appointed **Dr. T. G. Pickavance** as director of the Institute's High Energy Laboratory at Harwell. Dr. Pickavance is at present deputy head of the General Physics Division of the Atomic Energy Authority's Research Establishment at Harwell. The laboratory is to be known as the Rutherford High Energy Laboratory to commemorate the work of the late Lord Rutherford in the development of nuclear physics. It is being built on a site adjacent to the Atomic Energy Research Establishment, and will house the Institute's first large accelerator, a research machine of which the main part is a magnet ring 120-ft. in diameter weighing over 6,000 tons. Dr. Pickavance is at present officer in charge of the group within the Atomic Energy Authority responsible for the design and supervision of the construction of the new large accelerator for the Institute, and will continue to undertake this work. He has been working at Harwell since 1946 and has been deputy head of the General Physics Division since 1955.

G

OVERSEAS Steam Engineering Practice

Abridgments of recent articles in the colonial and foreign technical press, concerning design and progress in the technique of steam generation and power plant equipment

New 580-MW thermal power station

The new Bergen power station of the Public Service Electric and Gas Compauy of America, now under construction at Ridgefield, New Jersey, will increase the generating capacity of the company's system by 580-MW, an increase of 27½ per cent. over the December, 1956, figure. When complete the station will have two 290-MW Westinghouse cross-compound, 3,600 r.p.m. turbo-alternators, and two Foster Wheeler twin-furnace, natural-circulation, reheat steam generators, each with a capacity of 1,900,000 lb./hr. at 2,725 lb./sq. in. at a primary steam temperature of 1,100 deg. F., and a reheat temperature of 1,050 deg. F. The boilers will be coal-fired, and each unit will incorporate three Foster Wheeler, size D-8-D, pulverising mills of 36 ton/hr. capacity. Each steam generator comprises two continuous slagging steam-water-cooled furnaces, one serving a convection superheater section and the other a convection reheater section. Designed for pressurised operation, the units are equipped with forced-draught fans only. Induced-draught fans will not be provided. The "basketed" bottom of the furnace in the burner zone is fully water-cooled on the four sides and floor. The oval-shaped slag opening in the centre of the floor is protected by cooling tubes which are supplied with condensate from a source separate from the boiler circulating system. The three water-cooled division walls in each furnace are connected in series with the front and rear walls of the "basketed" bottom. Control of steam and metal temperatures is accomplished by means of Foster Wheeler transverse coil-type control condensers located at the radiant superheater inlets. Steam from the radiant superheater outlet in the convection reheater section is transferred to the inlet header of the convection superheater section where it is mixed with the steam from the radiant superheater in that section, passed through the convection superheater and then to the high-pressure turbine. Each section contains a bare tube economiser surface and two regenerative air heaters. Reheating is accomplished by means of all convection surface located in one section. Temperature control of reheat steam is by differentially firing the two furnaces. The turbo-alternators are the prototype of a new concept in the design of cross-compound machines which the Public Service Electric and Gas Company's engineering department has sponsored. Both elements of each cross-compound machine are exact duplicates, except that one shaft incorporates the high-pressure steam cylinder and the other the intermediate-pressure steam cylinder. The 3,600 r.p.m. low-pressure cylinders and the generators are duplicates. This arrangement of four identical electric generators and four identical low-pressure turbines results in savings in initial cost and in compactness of design. Boiler feed pumps are driven directly from the generators. This arrangement also results in a saving in first cost, and an improvement in operating efficiency. (*Heat Engineering*, Vol. 32, No. 5, pp. 70/71.)

Mechanised-drive steam turbine

Mechanical-driven turbines provide the means for converting heat energy directly to mechanical work without going through the process of converting it to electrical energy, then by the use of motors, back to mechanical energy. Horsepowers of such units range from 5-h.p. to 15,000-h.p. drives for large blast furnace blowers in steel mills. The smaller sets are of the single-stage, single-valve type, usually operated by low-pressure steam supplies. In order to cover a reasonable power range with these small turbines they are made in different frame sizes, the basic difference being the diameter of the turbine wheel—from as small as 14-in. up to 28-in. The efficiency of the single-stage turbine is quite low, and multi-stage units are able to take greater advantage of increased heat and steam pressures. With more than three stages, these units can produce up to 3,000-h.p. With the increased steam flow in multi-stage machines, the valve can be a problem if closer control is essential, and to solve this difficulty it is necessary for the unit to incorporate a vertical relay governor, a change which usually introduces a thrust bearing of the Kingsbury-type. With the vertical relay an oil-servo can be included to allow a more precise positioning of the valve, so that the speed change is smaller, and the valve can handle larger flows and horsepower, and make use of external process control. Further advantage of the increased efficiency from multi-stage machines can be taken by replacing the single-inlet valve by multiple valves. This reduces the quantity of available heat lost by throttling at part load. The servo-motor that operates the valves is located at the horizontal joint on the centre-line bracket. Multiple-inlet valves in the steam-chest are cast integrally with the turbine casing. They are operated by a bar-lift valve gear. The rotor and steam path components are the same as for the single-valve turbine. In the high-speed turbine range, power requirements start at around 1,500-h.p., with the majority at 3,000-h.p., and some as high as 8,000-h.p., and speeds up to 1,400 r.p.m. These speeds necessitate solid rotor construction, the shaft and discs being machined from one forging. In single-valve 'machines at these capacities vertical relay governors are used. Inlet valves are of the venturi-type, operated by oil-cylinders. For the larger horsepowers in the range multiple-inlet valves and bar-lift operators are used. The governor arrangement is the same as for the single-valve, and once again solid rotor construction is necessary with tapered blades on the last stage. In the more conservative speed range, but with large horsepowers, are such units as the turbines for driving blast furnace compressors. These furnaces take over 100,000 cu. ft./min. of air at 30 to 40 lb./sq. in., and with the new split-wind arrangement, operating more than one furnace from a single compressor, the power may approach 20,000-h.p. To effectively control the admission valves regulat-

ing the high-pressure steam flow, a cam-lift valve gear is used. Vertical oil relay governors are also incorporated on multi-valve units, the valve being moved by a double-acting oil-servo. The article, in addition to a general survey of this subject, deals with a number of specific installations. (*Power Engineering*, Vol. 61, No. 11, pp. 64/66.)

Murrumbidgee-Eucumbene river diversion

The Snowy Mountains Authority has taken a further step in the development of Australia's power resources by inviting tenders for another major project, the diversion of the Murrumbidgee river into the Eucumbene river at Adaminaby reservoir. The work includes a straight concrete gravity dam, slightly less than 150-ft. in height and approximately 710-ft. long at the crest. This dam will be built at an elevation of over 4,000-ft. above sea level at Tantangara on the Murrumbidgee river and will provide storage for the diversion of water through the Murrumbidgee-Eucumbene tunnel. The tunnel will be over 10 miles long and be horseshoe shaped with a cross-section area equivalent to that of an 11-ft. dia. circle. It is hoped that work will commence on the project early this year and that the dam will be complete in 1959. The tunnel need not be completed until 1960, but during the time between the completion of the dam and the tunnel, water will be stored in the Tantangara reservoir so that at least 200,000 acre feet of water will be available for diversion when the whole project is completed. Tenders have also been invited for two other major projects on the Snowy scheme. These were for the construction of a second large hydro-electric project on the Tumut river known as the T.2 Project and the diversion of the Tooma river into the Tumut river. The completion of this work will bring the total generating capacity of the scheme to 660-MW and the water available for irrigation to about 500,000 acre feet per annum.

The Electricity Trust of South Australia has placed orders for transformer and switchgear with Australian Electrical Industries (Pty.) Ltd. acting on behalf of **Metropolitan-Vickers Electrical Export Co. Ltd.** These orders, to a total value of about half-a-million pounds, were obtained in face of severe Continental competition, and include equipment for Port Augusta "B" power station and Magill substation. The equipment for Port Augusta includes both transformers and switchgear. Three 67-MVA 3-phase 50-c/s 11.3/275-kV transformers will be supplied to step up the generated voltage for transmission to Adelaide. These will have Metropolitan-Vickers type "M" resistor transition tap-changers fitted on the H.V. side for a tapping range of 20 per cent. in eighteen steps, with parallel and independent remote electrical control. Cooling will be "oil natural" for reduced output, and by the use of fans and oil pumps for full output. Also for Port Augusta are four 8,000-kVA shunt reactors of the coreless, iron-shield type with graded insulation. These are to form a 3-phase star-connected bank (with one spare unit) for use direct on a 275-kV earthed neutral system. One transformer and the four reactors are due for completion in May, 1959, and the remaining transformers in May, 1960 and May, 1961. A separate order is for twelve Metropolitan-Vickers type GA10X8F 275-kV air-blast circuit-breakers and associated equipment. Seven circuit-breakers, three of which will be fitted with high-speed reclosing equipment, are to be installed at the Port Augusta power station, together with the necessary central air compressing, drying and storage plant for their operation. Also included are twenty-four single-phase 275-kV outdoor current transformers and six capacitor voltage-transformers. The remaining five circuit-breakers, four of which are arranged for high-speed reclosure, will be installed at Magill substation. Compressor equipment is included, and as Magill will be a mesh station, current-transformers are to be fitted on both sides of the breakers, making a total of thirty 275-kV multi-secondary outdoor current-transformers.

The **Association des Ingenieurs Electriciens sortis de l'Institut Electrotechnique Montefiore** has organised a series of "International Study Days" on modern thermal power stations which will be held on May 27th to the 31st, 1958. These study days will be devoted to the discussion of reports submitted by foreign and Belgian specialists, on subjects concerning boilers, steam turbines, hydraulic turbines, and alternators. Numerous American, British, French, German, Swiss and Belgian delegates have already accepted invitations to submit reports. The reports will be published and sent to all participants before the opening of the study days. Official languages used at the meetings, which are to be held in the "Palais des Congres" of Liege, will be French, English and German. Technical visits and a tour of the Brussels International Exhibition are planned. Further details can be obtained from the Secretary, 1 rue de Spa, Liege (Belgium).

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A large tube mill, part of the seven-year organisation scheme of Iran, and one of the largest ever made at the works of **Edgar Allen & Co. Ltd.**, is in the final stages of construction and will be despatched shortly. The mill, weighing 130-tons, exclusive of the grinding charge, and measuring 8-ft. 0-in. diameter × 45-ft. 0-in. long, has a diameter smaller by only 6-in. than the largest ever made at the Imperial Steel Works. The mill is of such large size that after completion, it will be dismantled to facilitate transport, the end pieces and gearing being sent separately.

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The Cape Asbestos Company Limited (representative Mr. F. S. Page) and their subsidiary **Cape Building Products Limited** (representative Mr. M. W. Brodie) have opened a new office at Newcastle upon Tyne. The address is :— 19 & 20, Exchange Buildings, Quayside, Newcastle upon Tyne. Telephone : Newcastle 20488. The Newcastle office serves part of the Cape Asbestos northern area which is supervised by Mr. J. F. Callaghan, northern area manager, from Manchester. The Cape Building Products northern area manager is Mr. J. A. Fitzpatrick.

Electroflo Meters Co. Ltd., Abbey Road, Park Royal, London, N.W.10, have recently issued three new sales leaflets. The first, S.848, describes a new electronic control system for high capacity unit system power plants, which is a development of the company's well-known pneumatic and hydraulic systems. S.849 deals with the application of the Electroflo-Smoot automatic boiler control to shell-type boilers, to provide a continuous, simultaneous control of all controllable quantities. The third, 1700/S1, outlines the company's range of pyrometers, including controllers, recorders, indicators and potentiometers, with particular reference to the physical characteristics of the galvanometer movement which weighs only 2-grams, and the complete range of measuring elements.

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The manufacturers of Ciment Fondu, **Lafarge Aluminous Cement Co. Ltd.**, 73, Brook Street, London, W.1, have recently issued a 32-page booklet entitled, "The Cement for Industry." This publication should prove of interest, particularly to maintenance engineers, as it stresses a not widely known fact that the same Ciment Fondu can be used for making normal concrete; corrosion-resistant concrete; refractory concrete (using firebrick aggregate) for temperatures up to 1,350 deg. C.; and insulating concrete (using light-weight aggregate) for temperatures up to 1,000 deg. C. The booklet, which is "tabbed" for easy reference, contains full details of these concretes, recommended mixes, etc. Copies are available free of charge on application to the company.

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It is announced that **Ruston and Hornsby Ltd.**, Lincoln, and **J. L. Kier and Co. Ltd.**, London, have agreed to work in close technical collaboration on the design, development and building of nuclear power stations of 5-MW to 25-MW electrical generating capacity. A combined team is being established for this purpose at the Lincoln Works of Ruston and Hornsby Ltd.

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The Rt. Hon. Antony Head, C.B.E., M.C., M.P., has been elected a director of Associated Electrical Industries Limited.

Latest Power Plant Patents

These extracts from British Patent Specifications are reproduced by permission of The Controller of H.M. Stationery Office. (Complete British Specifications can be obtained from the Patent Office, 26, Southampton Buildings, London, W.C.2. Price 3s. 6d. each, both inland and abroad.)

Once-through boiler installation

It is much more important with forced-flow, once - through boilers than it is with drum-type boilers, to adapt the boiler output as rapidly as possible to variations in turbine load, especially if the boiler and turbine are operated as an integral unit. Thus, an attempt must be made to reduce to a considerable extent the inevitable influences delaying the changes in boiler output. Using an established method of regulating a forced-flow boiler, with simultaneous variation of the supply of fuel, air and feedwater, fine regulation of the temperature of the steam leaving the boiler by the injection of water into the steam and the employment of regulating impulses derived from the so-called " secondary heating surface " has proved to be advantageous. The further development of this method could prove advantageous, and it is suggested that this could be achieved by obtaining from the secondary heating surface sufficiently large regulating impulses with as little delay as possible. The invention described here is mainly concerned with this problem. Referring to Fig. 1 it will be seen that the inlet of the secondary heating surface (9) is connected to the feedwater supply pipe above the high-pressure pre-heater (7). The advantage of this arrangement can be assessed from the following consideration. Assuming the water to be heated at the secondary heating surface by 100 deg. C., and also assuming that the minimum temperature change which can be detected at the end of the secondary heating surface (9) is 2 deg. C., the sensitivity of the temperature sensing device is then 2/100 = 2 per cent. Let it now be assumed that the water is to enter the heating surface (9) at such a temperature that a heating by only 50 deg. C. occurs. The minimum detectable temperature change is still 2 deg. C., so that the heat sensing device detects 2/50 = 4 per cent. temperature variation, that is to say, the sensitivity of the measurement drops to half. If the secondary heating surface (9) were connected downstream of the last high-pressure regenerative stage, the water would enter the secondary heating surface at a correspondingly higher temperature with the result that the temperature rise in the secondary surface would be small, and the sensitivity of measurement would be correspondingly small. However, as in Fig. 1 the connection to the secondary heating surface (9) is taken from a point upstream of a high pressure

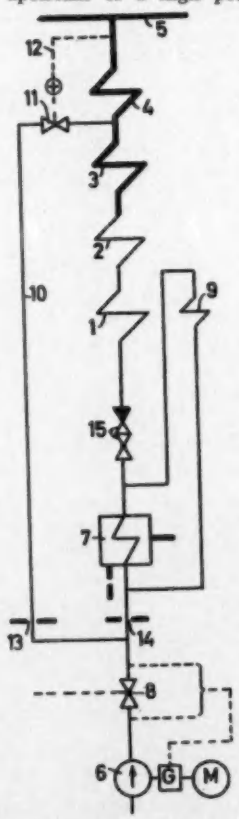


Fig. 1. British Patent No. 787,006.

stage of the regenerative process, the water now enters the heating surface at a relatively low temperature and there is thus a much greater temperature rise in the secondary heating surface and the sensitivity of measurement is considerably improved. Moreover, at the point where the pipe to the secondary surface branches off from the main feedwater pi pe the temperature of the water is now constant, or at least only slightly variable, depending on whether fixed pressure or suspension degasification is used. An immediate result is that unequivocal temperature measurement is possible. The quantity of water flowing through the boiler and the secondary heating surface is usually measured by means of a flow-meter. Since it is now possible to operate with a substantially constant temperature at the volume measuring point, the volume measurement is more reliable, since if the temperature is constant the specific volume of the water also remains substantially the same under all loads. Branching the pipe (10) from before a high-pressure preheater stage also affords the advantage that the injection water flowing through it is colder, i.e., a greater amount of heat can be taken from the superheated steam. There is also the advantage that reliable measurement of the quantity injected is possible. *British Patent No. 787,006 issued to Siemens-Schuckertwerke A.G. Application in Germany made on May 6th, 1955. Complete specification published November 27th, 1957.*

Steam generator with subdivided combustion chamber

A large amount of the heat released in modern water-tube steam boilers is absorbed directly through radiation to the circulation tubes lining the walls of the combustion chamber. Usually these tubes open into one or more steam drums in which the generated steam is separated and passed on to the superheater. Normally combustion takes place in a combustion chamber common to all the burners, but there are also types in which the combustion chamber is divided into smaller individual chambers by vertical partition walls. Fuel is supplied to the lower part of the combustion chamber, and, therefore, the combustion gases flow through the chamber in a substantially vertical direction, and in the same direction as the water. When changes of steam load occur, the final gas temperature in the upper part of the combustion chamber will be determined by the amount of fuel supplied, as when the steam load is

increased, the temperature of the flue gases leaving the combustion chamber is higher, whilst the temperature of the flue gases will be correspondingly lower when the steam demand is reduced. This in turn will contribute to changes in the absorption of the heat in the superheater in such a manner that a lower temperature in the gas passage beyond the combustion chamber results in a lower superheating temperature of the steam, and a higher temperature in the gas passage after the combustion chamber results in a higher steam temperature. It is important, however, in respect of the economy of a steam power plant, to keep the superheating temperature high within the greatest possible range of steam load, and, therefore, arrangements have been made to ensure that this is possible. For example, by a combination of a convection superheater and a superheater which is directly subjected to radiation, it is possible to minimise the variations of temperature of the flue gases. It is also possible to increase the superheater surface so that superheating to the highest permissible temperature of a reduced amount of steam is obtained, the temperature of the superheated steam then being adjusted in a suitable manner, for example, though cooling the steam by the injection of water. This invention provides the necessary means of attaining a uniform steam temperature over a wide range of steam load, without employing a superheater of a size that will require arrangements for subsequent cooling of the superheated steam at higher loads. According to the invention, the combustion chamber of the boiler is divided into a number of substantially horizontal chambers arranged one above the other, i.e., vertically grouped. The walls of the chambers are lined with bare water-tubes constituting substantially the entire radiation surface of the boiler, and connected in series with each other. Fig. 2 is a longitudinal section through the combustion chambers of a steam generator according to the invention, and Fig. 3 is a section on the line II-II of Fig. 2. The combustion chambers (1) are arranged in two groups with four chambers in each group located vertically one above the other. These chambers are cylindrical with horizontal axes. Ducts (2) are provided for the supply of fuel, for example, pulverised coal, which is seen to be introduced at one end of each cylindrical chamber. At the opposite end there is a central outlet opening (3), leading into a common flue gas channel (4). The gas flowing through the channel (4) first passes through a superheater divided into two parts (5a and 5b), through an economiser (6), and finally, via an air-preheater (7), to a fan (8) from where it is conveyed to the chimney. Combustion air is supplied by means of a fan (9) and passes the air-preheater (7) before flowing into a casing (10) which surrounds the chambers. The latter are provided with openings which may be arranged in any suitable manner, and through which air is supplied. *British Patent No.* 787,280 *issued to A/B Svenska Maskinverken. Application in Sweden made on June* 18th, 1954. *Complete specification published December 4th,* 1957.

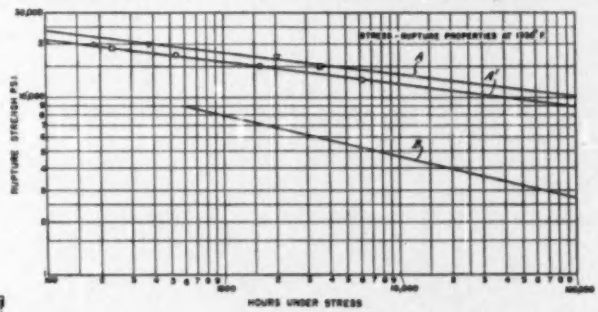


Fig. 4 (right). British Patent No. 788,468.

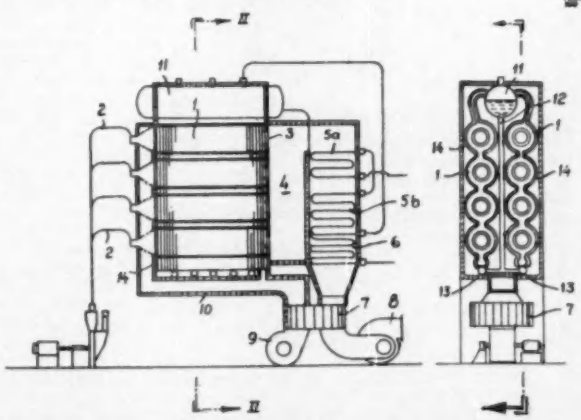


Fig. 2 (extreme left). British Patent No. 787,280.

Fig. 3 (left). British Patent No. 787,280.

High strength austenitic alloy steel

There has been a steady increase in the superheater outlet temperatures and pressures of steam generators, with a resulting increase in the efficiency and economy of steam turbines. These temperature and pressure increases required alloy steels, such as stainless steels of the niobium and titanium bearing 18 Cr-8Ni AISI types 347 and 321, to be used in the construction of superheaters. With superheated outlet temperatures of 1,050 deg. F., the pressures involved are frequently substantially in excess of 2,000 lb./sq. in. With pressures of this order the superheater tubing must have wall thicknesses of up to $\frac{3}{4}$ in. for such 18-8 alloys to remain within their allowable working stresses. Such wall thicknesses are undesirable not only from the standpoint of fabrication problems, but also from the standpoints of heat transfer and thermal stress gradients across the wall of the tubing. As a consequence the increase in superheater temperatures has recently been arrested at approximately the 1,100 deg. F. level. Any further substantial increase in superheater outlet temperatures will require steel alloys capable of practical fabrication into tubing having wall thicknesses acceptable from the fabrication, heat-transfer, and thermal stress gradient aspects, and having long-life strength and corrosion resistance at temperatures in excess of 1,350 deg. F. and pressures substantially in excess of 2,000 lb./sq. in. This invention relates to a steel alloy capable of economically practical use as a tubing operating at 1,350 deg. F. with pressures in excess of 2,000 lb./sq. in. and having the lowest possible alloy content, being particularly low or " lean " in strategically important elements. The invention aims at providing a steel meeting the following requirements : (i) Stress-rupture strength at 1,350 deg. F. at least twice that of A.I.S.I. Type 304 alloys ; (ii) adequate resistance to corrosion by superheated

steam and combustion gases at 1,350 deg. F.; (iii) adequate hot plasticity for fabrication into tubing; (iv) favourable mechanical properties; (v) weldability; (vi) freedom from serious embrittlement in long-time service at such high temperatures. To meet these requirements the alloy has the following basic composition:

	(per cent.)
Cr	14.36-20.00
Ni	12.00-18.00
C	0.02- 0.15
Mn	0.25- 2.50
Si	0.10- 1.03

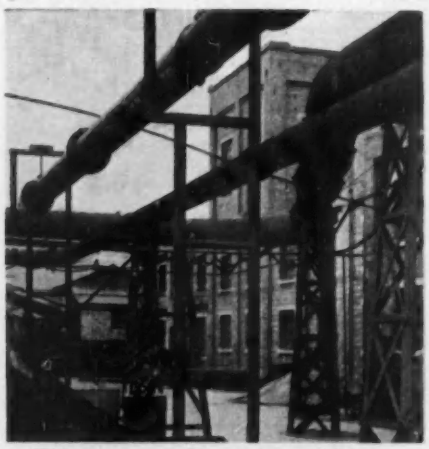
In accordance with the invention the creep rupture of the basic composition is very substantially increased by adding to it from 1.0 per cent. to 3.5 per cent. Ta or TaNb. To this may be added Cu up to 3.0 per cent. with or without Mo up to 3.0 per cent. A preferred composition for superheater tubing is as follows:

	(per cent.)
Cr	17.00 max.
Ni	15.00
C	0.15
Mn	2.00
Si	0.75
Ta or TaNb ..	1.5-3.5

The curves A and A^1 of Fig. 4 represent the stress-rupture values of the new alloys without the Cu and Mo additions, while curve B represents those of an AISI-type-304 18 Cr-8Ni alloy. It will be observed that at 1,000 hours the stress rupture strength of the new alloys is 16,000-18,000 lb./sq. in. which is over twice that of the type 304-alloy. At 10,000 hours, the stress-rupture strength of the new alloys is 12,000-13,500 lb./sq. in. as compared with about 4,700 lb./sq. in. for the type-304 alloy. At 100,000 hours, the indicated stress-rupture strength of the new alloys is 9,000-10,000 lb./sq. in. as compared with 2,700 lb./sq. in. for the type-304 alloy. The values for the AISI-type-304 alloy are taken from the ASTM-ASME Spec. Tech. Publ. No. 124. *British Patent No.* 788,468 *issued to The Babcock and Wilcox Co. Application in U.S.A. made on July* 30*th*, 1954. *Complete specification published January 2nd*, 1958.

VETERAN STEAM MAIN

An enquiry for the installation of a new 18-in. steam main at the N.C.B.'s Coventry Colliery, Keresley, early last year, revealed some remarkable facts about the existing 22-in. steam pipeline supplied by Stewarts & Lloyds Limited—as far back as 1912—to the (then) Warwickshire Coal Company. The National Coal Board have now given permission for these facts to be published.



The 22-in. steam main between boiler house and winding-engine house at Coventry Colliery, Keresley, which was installed by Stewarts & Lloyds Ltd. in 1912, *and which is still in use. The illustration also shows part of a new* 18-*in. steam main.*

This 45-year-old main, which conveys steam from the boiler house to the two pit winding engines, has been in constant service without any major repair from the date of installation to the present day. We understand that a copy of the original arrangement drawing is still in existence. It appears that during all these years no major shut-down of the plant could be allowed because the main, being a single line, was required to operate at least one winding engine at all times. Presumably installed at about the same time as the main, the winding engines are stated to be in excellent working condition, and compare still and match in efficiency with modern electrical winding gear. A record was set up at the beginning of the last war when 71 complete runs—including the loading and unloading of tubs—were made within one hour. At that time the pit was 720 yards deep with a workable coal seam of 21 ft. in height.

As it is large enough to act as its own reservoir there is no steam accumulator on the line—which means that, throughout its long life, the old steam main has been worked very hard indeed.

Some 20 members of the fifth course for Instrument Mechanics held a few weeks ago at the C.E.A. training establishment at Horsley Towers, paid a visit to the Bisco Road, Luton works of **George Kent Ltd.** Most of the day was taken up in making a tour of the workshops, where the visitors saw the machining and assembly of many instrumentation products which they normally handle at C.E.A. power stations.

* * *

Crofts Engineers (Holdings) Ltd. has announced that **Mr. John Midgley** has been appointed managing director of its subsidiary company, Carter Gears Ltd. in succession to **Mr. Maurice Carter.** Mr. Carter remains a director.

During the recent tour of British industrial installations by members of the Canadian Trade Mission, fifteen members of the mission visited Berkeley nuclear power station, being built by A.E.I.-John Thompson Nuclear Energy Company Limited. The party, led by Mr. James Duncan, chairman of the Ontario Hydro-Electric Power Commission, was received by Sir Edward Thompson (chairman of John Thompson Limited and a director of A.E.I.-John Thompson), and by directors representing other contracting companies at Berkeley. Members of the Mission showed considerable interest in the progress made at the site in the 10½ months in which work had been in progress. Inside No. 1 reactor house they saw welding in progress on the 1,000-ton reactor vessel, the lower domed portion of which is now in position and surrounded by the thermal shielding. The party also visited the site boiler shop in which John Thompson Ltd. are now welding together the seven sections which make up the first 130 tons heat-exchanger vessel. Sections of this vessel were fabricated at Wolverhampton and transported by road to Berkeley.

* * *

G. & J. Weir Ltd. has announced the formation of a new organisation in Rotterdam. Its address is Weir (Holland) N.V., West Zeedijk, 106, Rotterdam. The resident director is Mr. W. Atkinson Adam.

* * *

It is announced that **Mr. O. D. Angell** has been elected chairman of The British Vacuum Cleaner and Engineering Company Limited.

* * *

Davy & United Engineering Company Limited, has announced the appointment of **Mr. M. F. Dowding,** M.I.Mech.E., as chief engineer. **Mr. A. A. Thomas,** A.M.I.Mech.E., has been appointed engineering sales manager in succession to Mr. Dowding.

* * *

Brook Motors Ltd. has announced the transfer of **Mr. W. Ford,** sales engineer at its Swansea sales office, to its sales office in Birmingham. Mr. Ford will replace **Mr. H. C. Curtis,** who has recently left the company's service.

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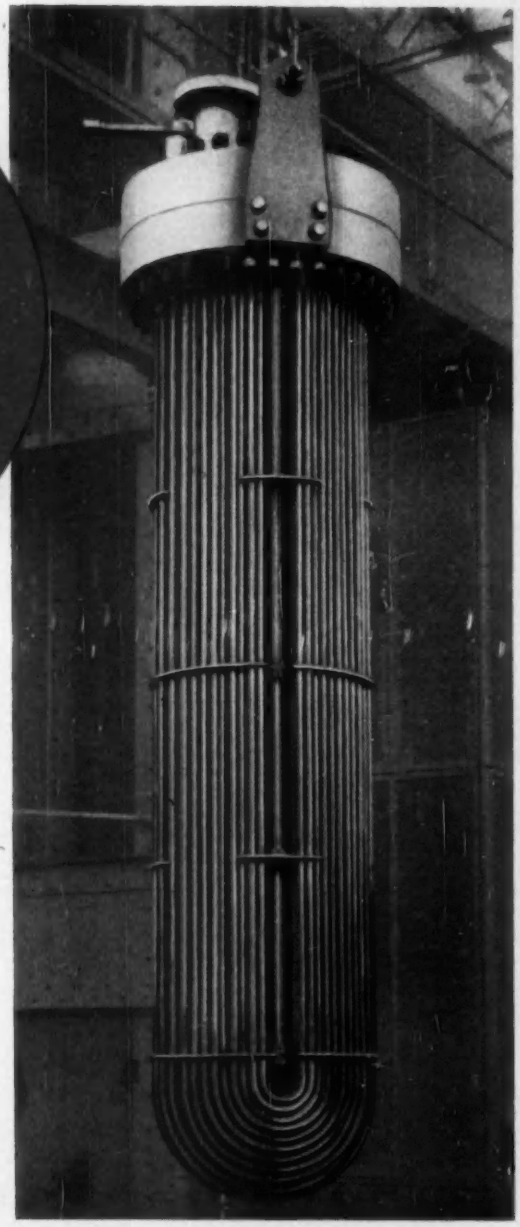
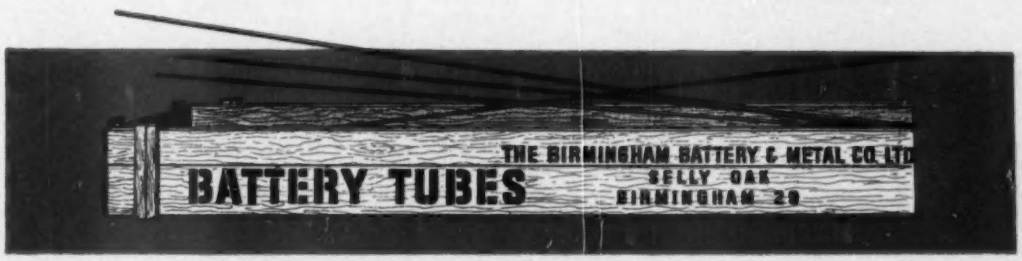


This illustration of a nest of 'B.B' U-Tubes is reproduced by courtesy of the C.E.A., Midlands Division.



NOTES Personal AND Industrial

The Rt. Hon. Sir David Eccles, K.C.V.O., M.P., President of the Board of Trade, will open Britain's largest-ever display of electrical equipment at The Electrical Engineers Exhibition, to be held at Earls Court, on March 25th, 1958. The exhibition will be open daily from March 25th to 29th.

* * *

Sir Harold Yarrow, Bt., C.B.E., LL.D., M.Inst.C.E., chairman and managing director of Yarrow & Co. Ltd., has been created a Knight Grand Cross of the Order of the British Empire (G.B.E.).

* * *

It is announced that H.M. Government in the United Kingdom have appointed **Dr. H. W. Melville,** F.R.S., secretary of the Department of Scientific and Industrial Research, to succeed Sir Ben Lockspeiser, K.C.B., F.R.S., as one of their delegates to the Council of the European Organisation for Nuclear Research (C.E.N.R.). Sir Ben, who, until the end of 1957, was also president of the council of C.E.N.R., retired from the United Kingdom public service in March, 1956, and has now asked to be relieved of his responsibilities as a council member. The other U.K. delegate to C.E.N.R. is **Sir John Cockcroft,** O.M., K.C.B., C.B.E., F.R.S.

* * *

A Knighthood was conferred in the New Year Honours on **Dr. Ashley S. Ward,** President of Thos. W. Ward Ltd., Albion Works, Sheffield. Dr. Ward, a nephew of Thomas W. Ward, the founder, joined the firm as a young man. He was afterwards sent to London to promote Ward's interests in the south, and subsequently established the extensive Silvertown Works. He became successively assistant managing director, joint managing director and in 1941 was appointed chairman and managing director on the death of Dr. Joseph Ward, J.P., a younger brother of the founder of the firm. He continued in this office until 1950 when he was appointed the first president of the company, a post he still holds. In addition to his presidency of Thos. W. Ward Ltd., Dr. Ward is chairman of the Park Gate Iron & Steel Co. Ltd., vice-chairman of Laycock Engineering Co. Ltd., and a local director of the National Provincial Bank Limited.

* * *

Following the coming into operation of the Electricity Act, 1957, **Mr. David Cleghorn Thomson** relinquished his appointment as director of welfare to the Central Electricity Authority as from December 31st, 1957, on terms mutually agreed.

* * *

G. & J. Weir Ltd., Glasgow, announce the retirement, on medical advice, of **Mr. David C. Hagen,** head of their technical division, after 47 years service.

The United Steel Companies Limited announce the following appointments to the boards of three of their branch companies: **Mr. K. G. Lampson,** managing director (sales) and **Lt. Col. P. F. Benton Jones,** managing director (mining and carbonisation) of United Steel Companies Limited, have been appointed directors of Samuel Fox & Co. Ltd. and of Appleby-Frodingham Steel Company. **Lt. Commander G. W. Wells,** director and general manager of Appleby-Frodingham Steel Company and **Mr. R. J. Bavister,** commercial manager of Samuel Fox & Co. Ltd., have been appointed directors of Samuel Fox & Co. Ltd. **Mr. I. M. Kemp,** chief design engineer of Appleby-Frodingham Steel Company, has been appointed a director of that company. **Mr. R. P. Crawshaw,** general sales manager and chief purchasing agent of United Steel Companies Limited, has been appointed a director of United Steel Structural Company Limited.

* * *

Mr. A. D. Murray, a joint managing director of Prior Stokers Ltd. since 1945, has retired after over 23 years' service, and has resigned as a director. He will, however, continue to act in an advisory capacity. **Mr. J. P. Anderson,** who has been the company's Scottish manager since 1946, has joined the board. **Colonel A. de Chimay** is now sole managing director, and remains deputy chairman of the company.

* * *

Mr. N. C. Lake has been appointed a director and deputy managing director of **Head Wrightson & Co. Ltd.** He will be responsible for the co-ordination of the group sales to the iron and steel industry. Mr. Lake was formerly managing director of the Head Wrightson Machine Co. Ltd. **Mr. Douglas Dodds-Parker,** M.P., has joined the board of the Head Wrightson Export Co. Ltd.

* * *

Mr. W. Hucker, secretarial officer and former information officer of the South Western Electricity Board, has been appointed Group Publicity Manager for the Lancashire Dynamo Group at St. Stephen's House, Westminster, S.W.1. Mr. Hucker was for several years industrial correspondent of the "Bristol Evening Post" before he was appointed the South Western Board's Information Officer in 1951. Two years ago his responsibilities were extended to cover a wider field of public relations, including liaison duties with the South Western Electricity Consultative Council.

* * *

Mr. W. T. Vizer-Harmer, commercial manager of Steel, Peech and Tozer, branch of the United Steel Companies Limited, has been appointed commercial director. He has been succeeded by **Mr. J. Mackenzie-Mair.**

Following upon the recent acquisition by **James Hodgkinson (Salford) Limited** of a controlling interest in Bennis Combustion Limited, **Mr. G. M. Mellor** has relinquished the appointment of joint managing director of Bennis Combustion Limited, in order to concentrate on the sales activities of the company. He will continue to serve as chairman. **Mr. B. W. Dawkins** has been appointed a joint managing director. The constitution of the board of Bennis Combustion Limited is now as follows: G. M. Mellor, A.I.Mar.E. (chairman); F. Howarth (joint managing director); B. W. Dawkins (joint managing director); R. B. Page, A.M.I.Mech.E.; J. S. A. Hodge, F.A.C.C.A., F.T.I.I.; N. C. Crighton, A.M.I.Mech.E., M.Inst.F.; E. L. Hollinshead. Messrs. Hodge, Crighton and Hollinshead are also directors of James Hodgkinson (Salford) Limited.

* * *

Kent Continental Société Anonyme, the Belgian subsidiary of **George Kent Ltd.,** Luton, announces that, as a result of the expansion of its activities, it has moved into larger premises at 27, rue Paul-Emile Janson, Brussels. Telephone No.: Brussels 38.31.84. The new building houses not only the sales offices, but also the service department with well-equipped workshops as well as stores containing a comprehensive stock of spare parts for all Kent products.

* * *

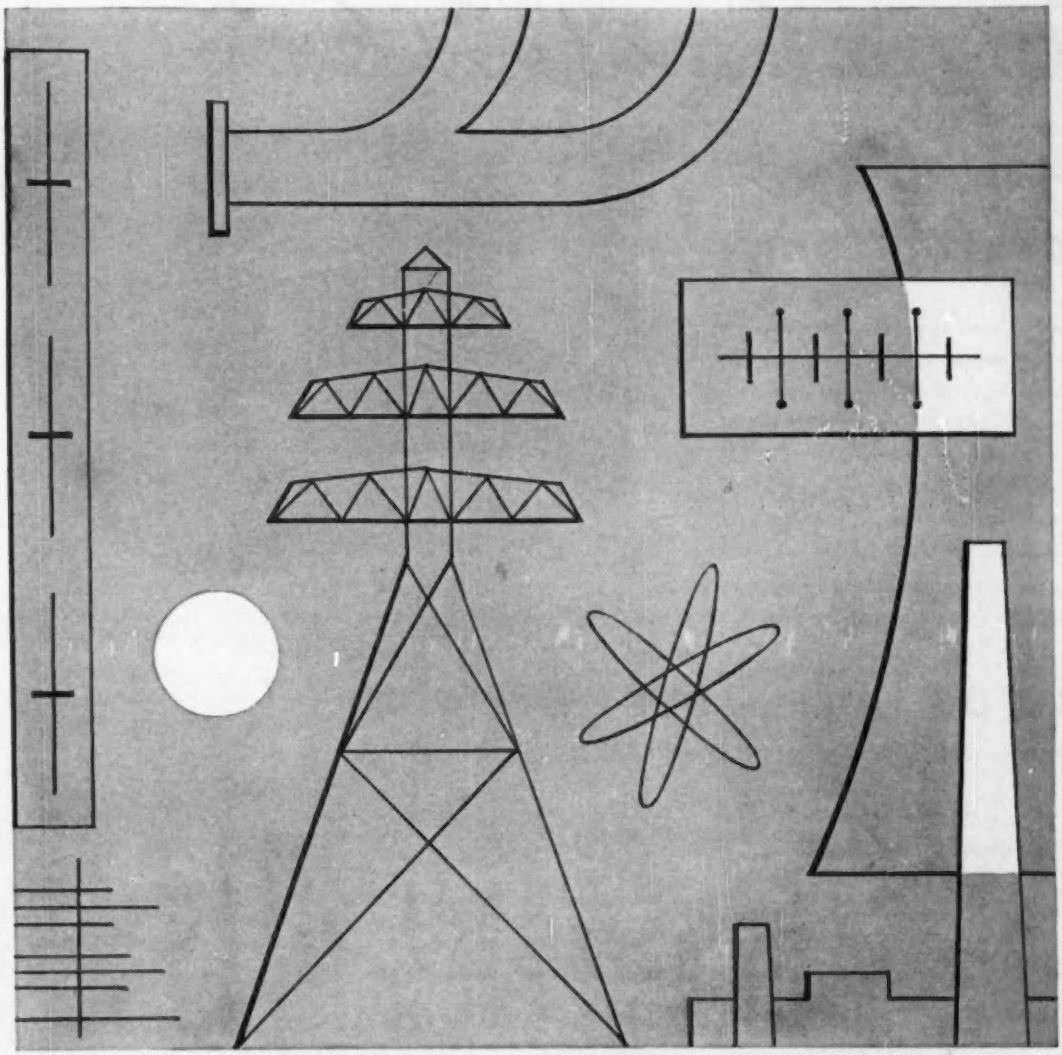
A subsidiary company has been formed in the U.S.A. by **Megator Pumps & Compressors Ltd.** (42, Berkeley Square, London, W.1) to handle their American business in industrial and marine self-priming pumps. The new company, known as **Megator Pumps & Compressors Inc.,** will be responsible for marketing Megator pump sets—produced in the U.K., by the parent company to American standards—throughout the United States, and will provide efficient after-sales service when required. The address of the new company is 930, Manchester Avenue. Pittsburgh 12, Pa.

* * *

Mr. J. E. C. Bailey, C.B.E., chairman and managing director, Baird and Tatlock (London) Ltd. and Hopkin and Williams Ltd., left London on January 18th, to visit the companies' branches, agents and representatives in Rhodesia, South Africa, Australia, New Zealand, Singapore and Ceylon.

* * *

The Head Wrightson Export Company Limited of 20, Buckingham Gate, London, S.W.1, announces that **Mr. Anthony Neville** joined the company on January 1st, 1958, as European manager. Mr. Neville was, until taking up this new appointment, in the International Department of the British Iron & Steel Federation.



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The United Steel Companies Limited announce the following appointments to the boards of three of their branch companies: **Mr. K. G. Lampson,** managing director (sales) and **Lt. Col. P. F. Benton Jones,** managing director (mining and carbonisation) of United Steel Companies Limited, have been appointed directors of Samuel Fox & Co. Ltd. and of Appleby-Frodingham Steel Company. **Lt. Commander G. W. Wells,** director and general manager of Appleby-Frodingham Steel Company and **Mr. R. J. Bavister,** commercial manager of Samuel Fox & Co. Ltd., have been appointed directors of Samuel Fox & Co. Ltd. **Mr. I. M. Kemp,** chief design engineer of Appleby-Frodingham Steel Company, has been appointed a director of that company. **Mr. R. P. Crawshaw,** general sales manager and chief purchasing agent of United Steel Companies Limited, has been appointed a director of United Steel Structural Company Limited.

* * *

Mr. A. D. Murray, a joint managing director of Prior Stokers Ltd. since 1945, has retired after over 23 years' service, and has resigned as a director. He will, however, continue to act in an advisory capacity. **Mr. J. P. Anderson,** who has been the company's Scottish manager since 1946, has joined the board. **Colonel A. de Chimay** is now sole managing director, and remains deputy chairman of the company.

* * *

Mr. N. C. Lake has been appointed a director and deputy managing director of **Head Wrightson & Co. Ltd.** He will be responsible for the co-ordination of the group sales to the iron and steel industry. Mr. Lake was formerly managing director of the Head Wrightson Machine Co. Ltd. **Mr. Douglas Dodds-Parker,** M.P., has joined the board of the Head Wrightson Export Co. Ltd.

* * *

Mr. W. Hucker, secretarial officer and former information officer of the South Western Electricity Board, has been appointed Group Publicity Manager for the Lancashire Dynamo Group at St. Stephen's House, Westminster, S.W.1. Mr. Hucker was for several years industrial correspondent of the "Bristol Evening Post" before he was appointed the South Western Board's Information Officer in 1951. Two years ago his responsibilities were extended to cover a wider field of public relations, including liaison duties with the South Western Electricity Consultative Council.

* * *

Mr. W. T. Vizer-Harmer, commercial manager of Steel, Peech and Tozer, branch of the United Steel Companies Limited, has been appointed commercial director. He has been succeeded by **Mr. J. Mackenzie-Mair.**

Following upon the recent acquisition by **James Hodgkinson (Salford) Limited** of a controlling interest in Bennis Combustion Limited, **Mr. G. M. Mellor** has relinquished the appointment of joint managing director of Bennis Combustion Limited, in order to concentrate on the sales activities of the company. He will continue to serve as chairman. **Mr. B. W. Dawkins** has been appointed a joint managing director. The constitution of the board of Bennis Combustion Limited is now as follows: G. M. Mellor, A.I.Mar.E. (chairman); F. Howarth (joint managing director); B. W. Dawkins (joint managing director); R. B. Page, A.M.I.Mech.E.; J. S. A. Hodge, F.A.C.C.A., F.T.I.I.; N. C. Crighton, A.M.I.Mech.E., M.Inst.F.; E. L. Hollinshead. Messrs. Hodge, Crighton and Hollinshead are also directors of James Hodgkinson (Salford) Limited.

* * *

Kent Continental Société Anonyme, the Belgian subsidiary of **George Kent Ltd.,** Luton, announces that, as a result of the expansion of its activities, it has moved into larger premises at 27, rue Paul-Emile Janson, Brussels. Telephone No.: Brussels 38.31.84. The new building houses not only the sales offices, but also the service department with well-equipped workshops as well as stores containing a comprehensive stock of spare parts for all Kent products.

* * *

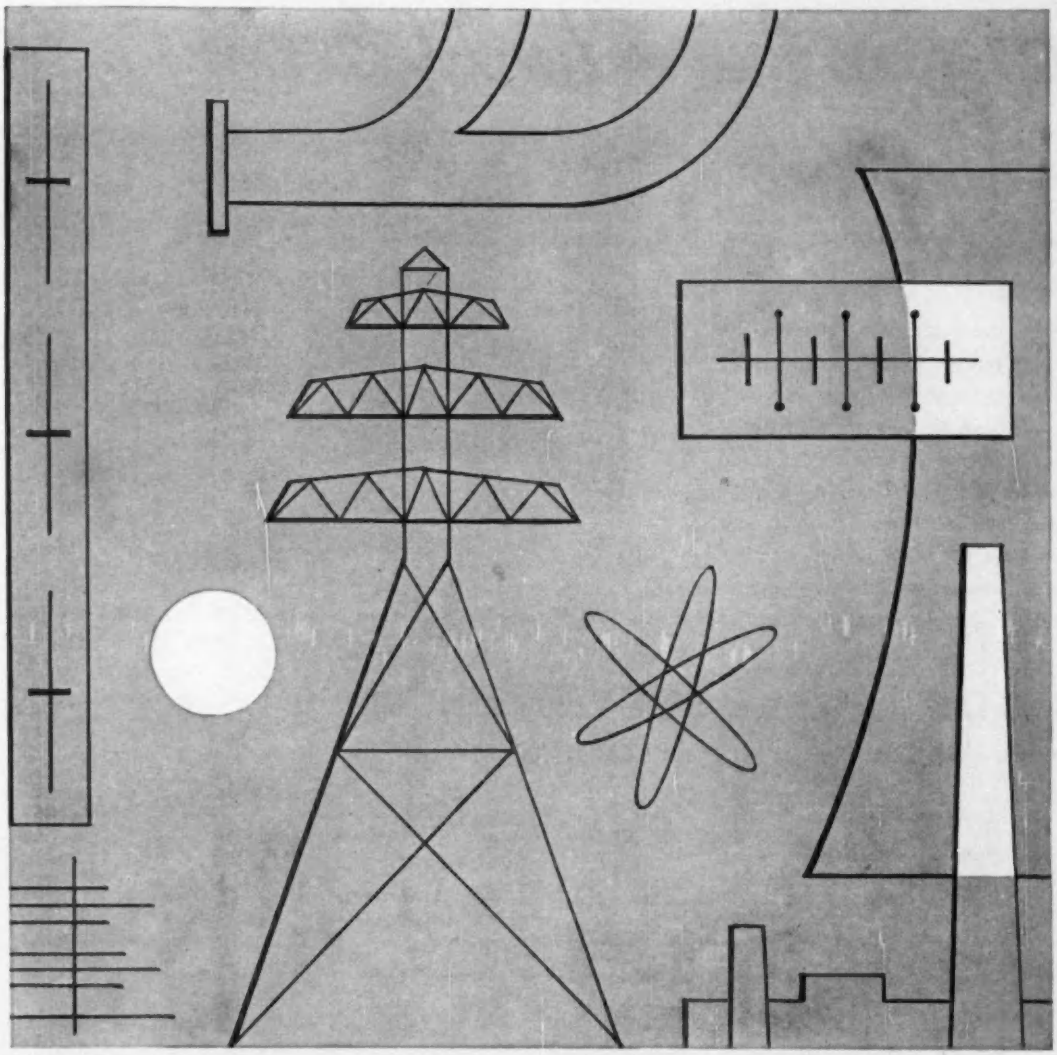
A subsidiary company has been formed in the U.S.A. by **Megator Pumps & Compressors Ltd.** (42, Berkeley Square, London, W.1) to handle their American business in industrial and marine self-priming pumps The new company, known as **Megator Pumps & Compressors Inc.,** will be responsible for marketing Megator pump sets—produced in the U.K., by the parent company to American standards—throughout the United States, and will provide efficient after-sales service when required. The address of the new company is 930, Manchester Avenue. Pittsburgh 12, Pa.

* * *

Mr. J. E. C. Bailey, C.B.E., chairman and managing director, Baird and Tatlock (London) Ltd. and Hopkin and Williams Ltd., left London on January 18th, to visit the companies' branches, agents and representatives in Rhodesia, South Africa, Australia, New Zealand, Singapore and Ceylon.

* * *

The Head Wrightson Export Company Limited of 20, Buckingham Gate, London, S.W.1, announces that **Mr. Anthony Neville** joined the company on January 1st, 1958, as European manager. Mr. Neville was, until taking up this new appointment, in the International Department of the British Iron & Steel Federation.



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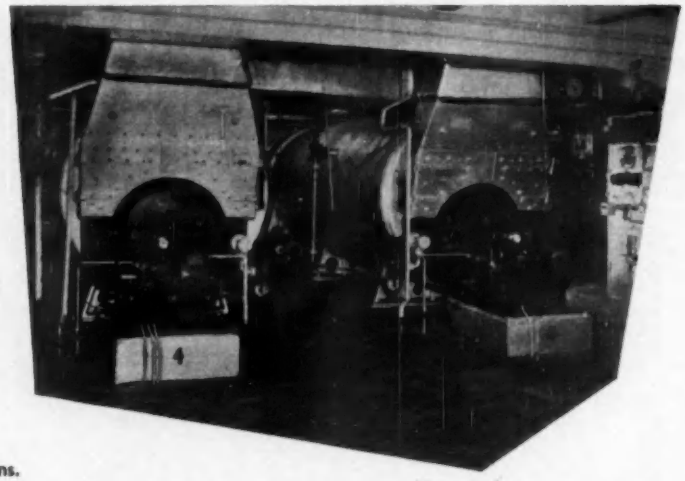

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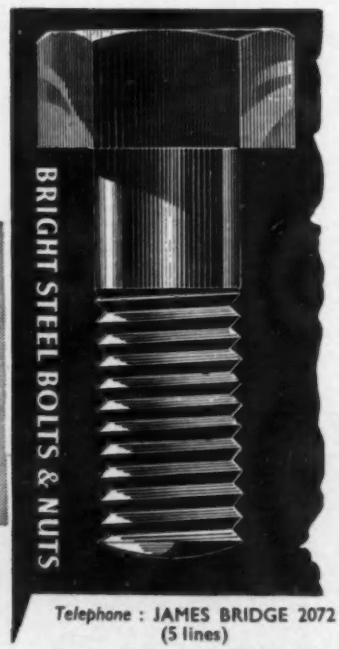

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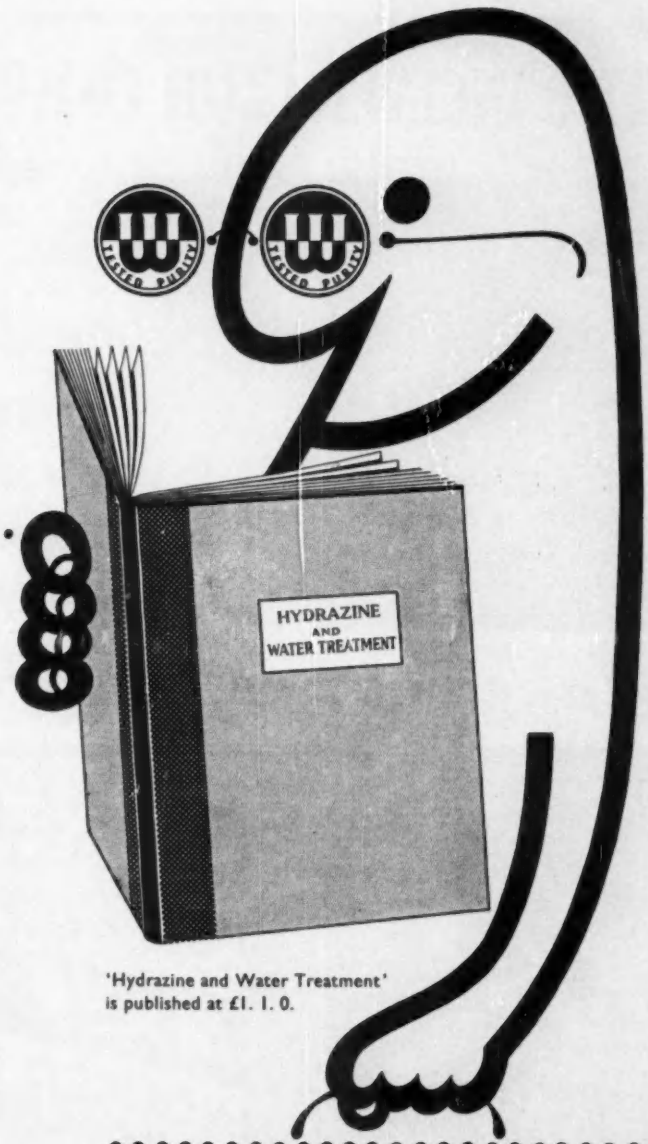

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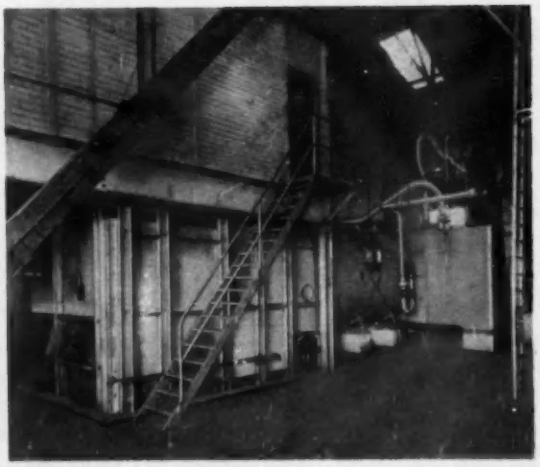

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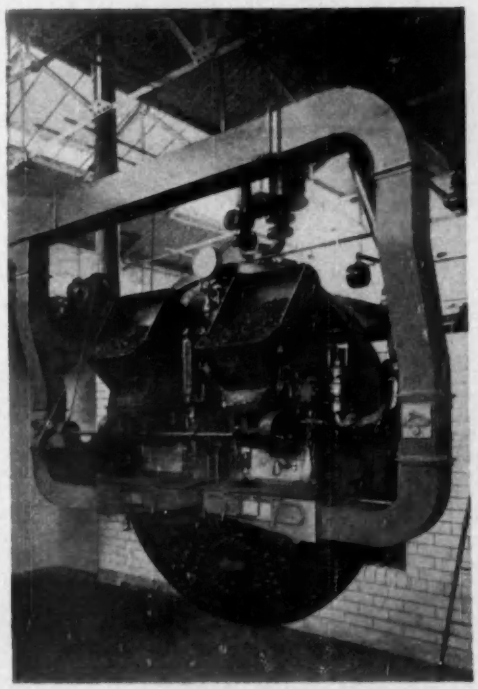

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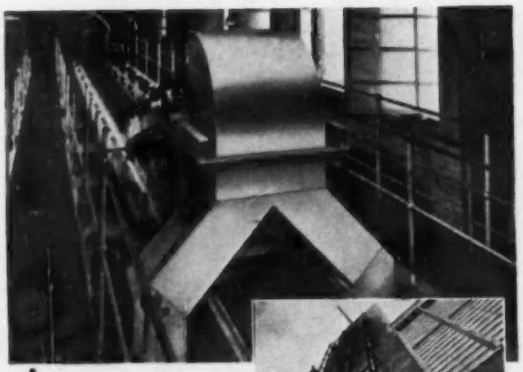
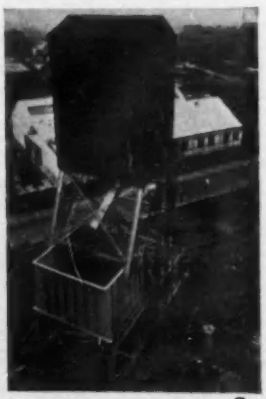


A

B

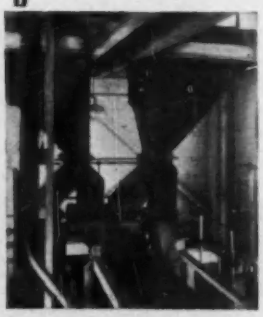
coal and ash on the move

The plant shown here—in operation at a large manufacturers of synthetic dyestuffs—is a typical "Bennis" Coal and Ash Handling installation. It successfully, and *economically*, overcomes those problems inherent in coal firing—the handling of fuel and disposal of ash. The illustrations give a broad idea of the functions of the various units employed and of their application to other industrial undertakings.



C

D



A *24" coal conveyor and throw-off carriage serving storage bunkers.*

B *Elevated rolled steel track for twin skip hoists each of 35 tons per hour capacity.*

C *Ash hoist and 50 ton bunker served from underground conveyor.*

D *Coal being fed evenly from skip hoists on to conveyor serving storage bunkers.*

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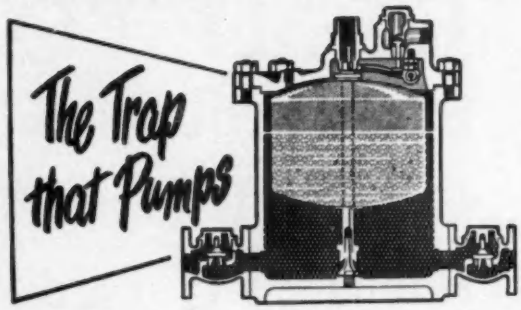

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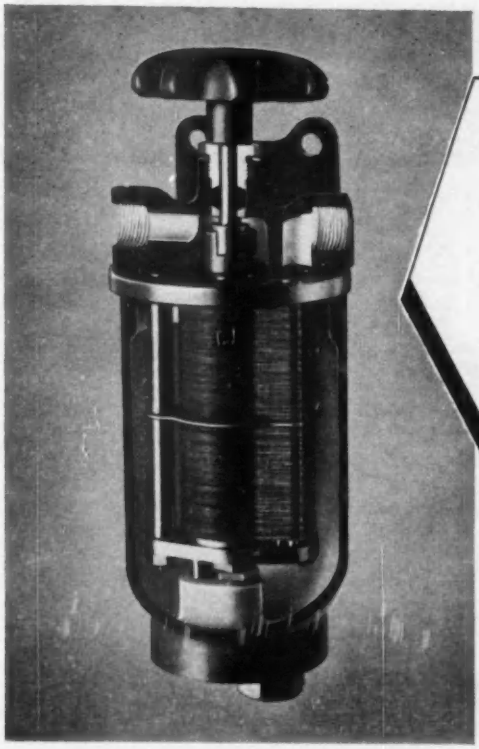

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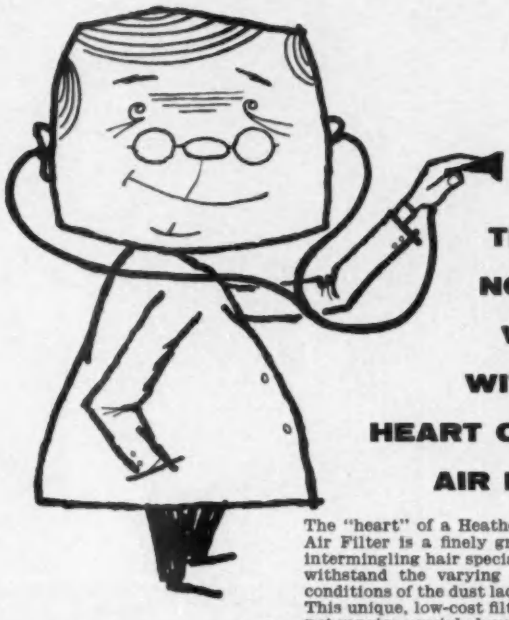

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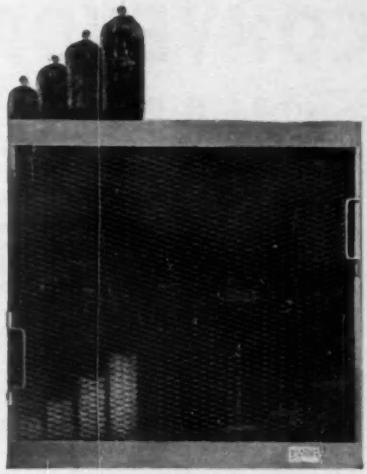

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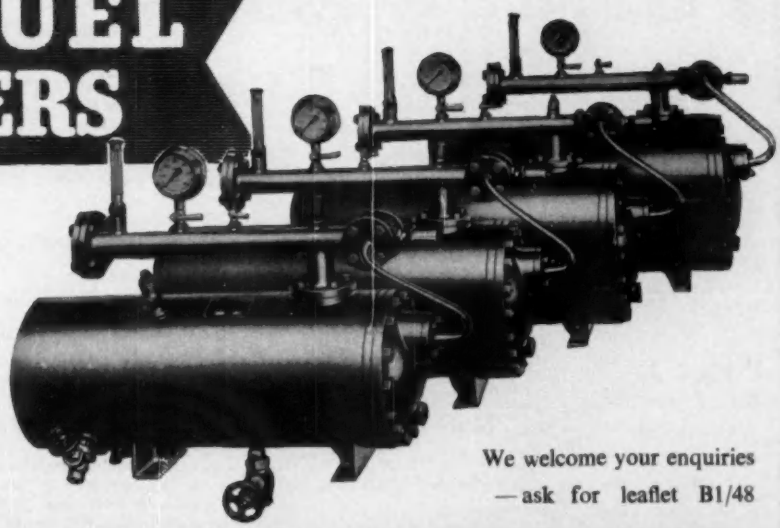

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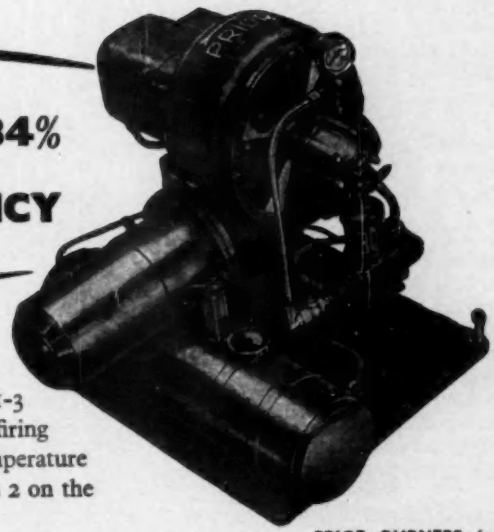

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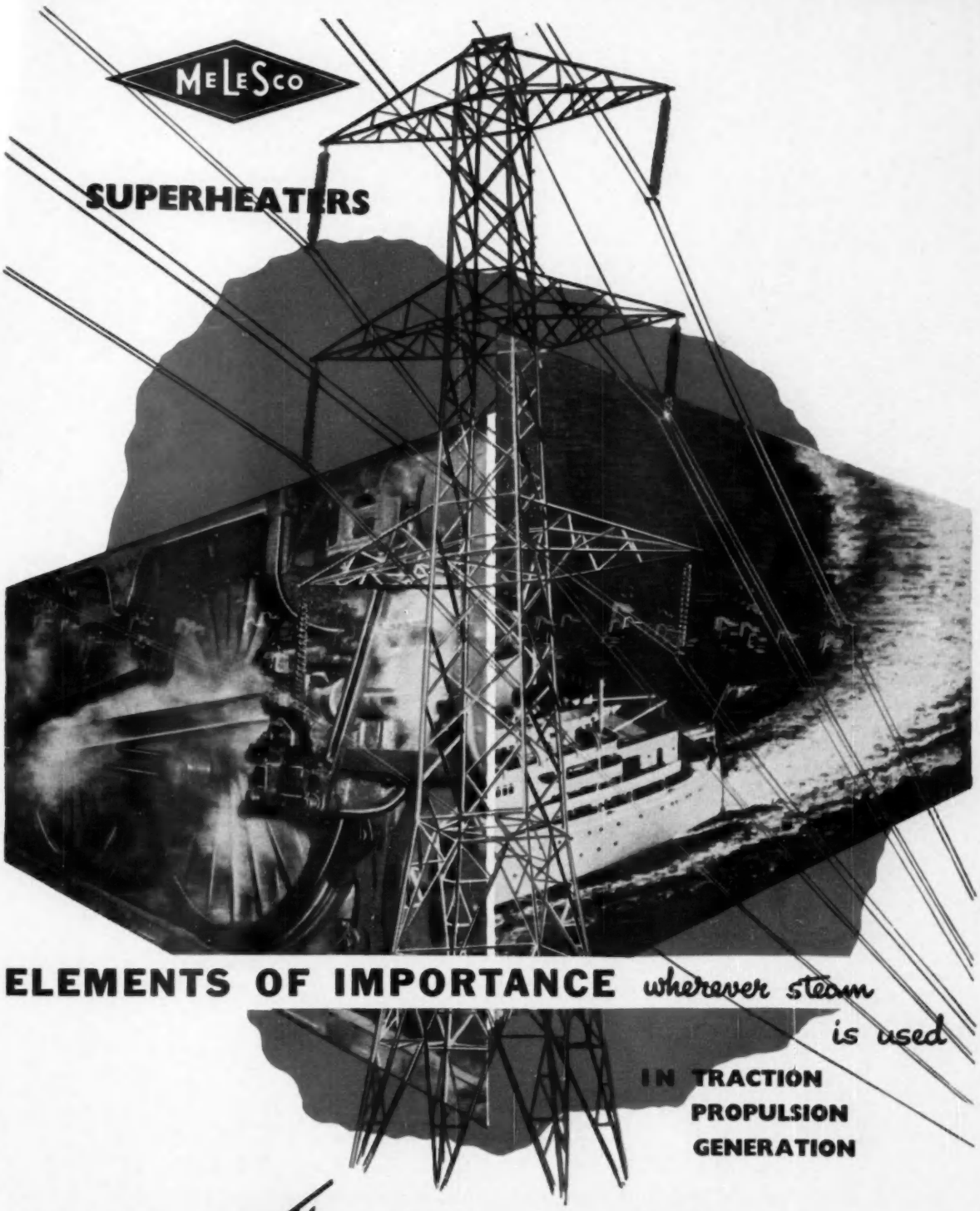

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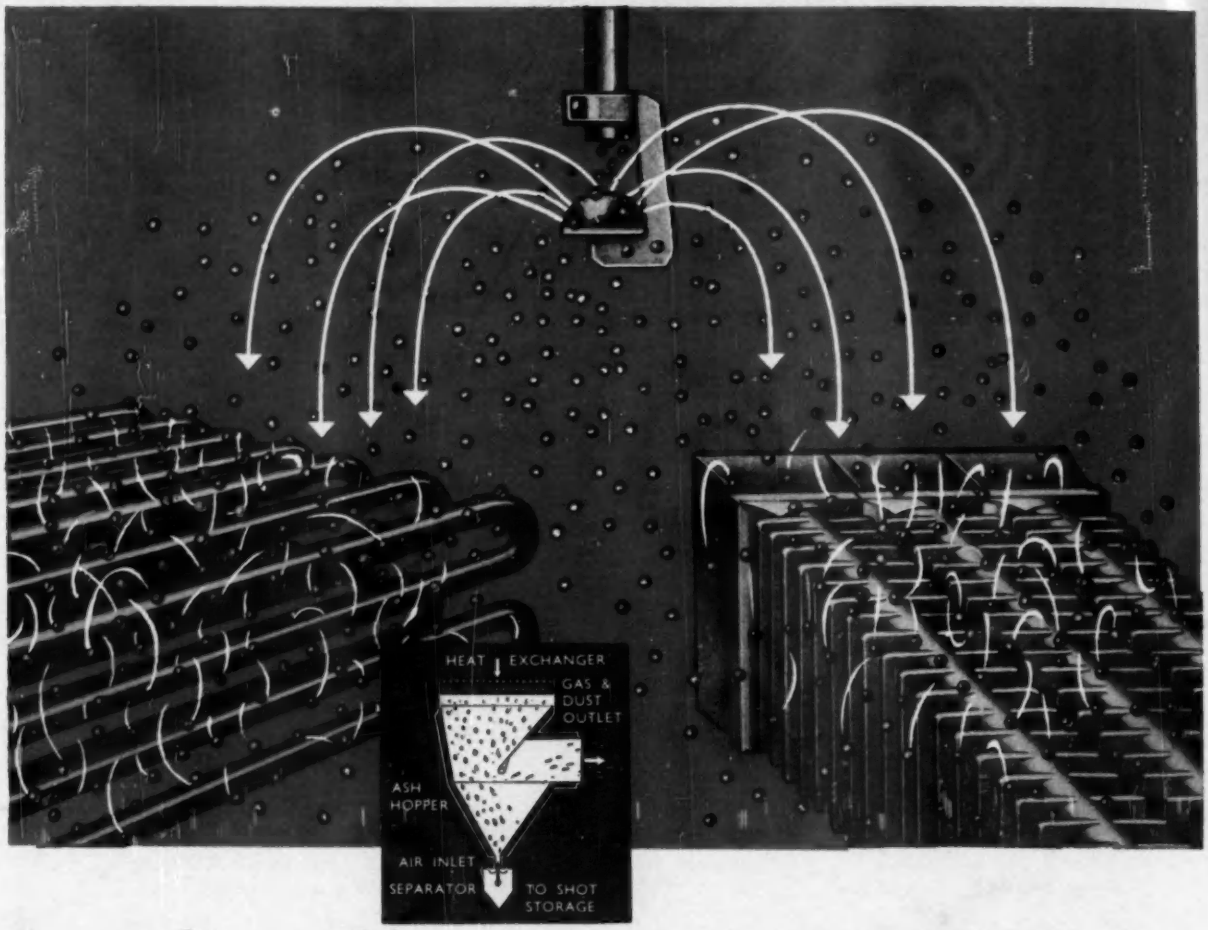

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Printed by Electrical Press Ltd., at Cordwallis Works, Maidenhead, Berks.
Registered for transmission by Magazine Post to Canada including Newfoundland.